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Musical Instruments, Music, &c.—J. Pooley, H. Smith, A. G. Gregory, R. Howson.

Nails, Spikes, Bolts, Rivets, Screws, &c.—J. H. Johnson (com.)

Oiling or Lubricating, &c.—H. J. Haddan (com.), H. J. Haddan (com.)

Oils, Fatty Matters, Grease.—P. M. Justice (com.), W. E. Gedge (com.), W. R. Lake (com.), J. C. Mewburn (com.)

Optical Instruments, Optical Illusions, &c.—T. H. S. Hawker.

Ovens and Kilns.—W. W. Pilkington, M. Bauer (com.)

Packing Pistons, &c.—J. W. Preston (com.), J. W. Preston (com.), B. Harlow, J. Wills, W. Oliver.

Packing, Storing, Baling, &c.—B. Tydeman, W. J. Menzies, J. H. Thomas, A. Coates.

Paper, Pasteboard, Papier Mache: Paper Hangings.—J. Wetter (com.), J. F. Cheesbrough (com.), R. A. Fisher, R. A. Fisher, H. G. White, J. Collins.

Photography and Photographic Apparatus, Pictures, Portraits, &c.—G. C. Bell.

Photometers.—L. Warnerke.

Pictures, Paintings, &c.—L. Hostcombe (com.) G. C. Bell.

Pipes, Tubes, and Syphons: Joining Pipes.—J. Wilkes, J. W. Newall, C. E. Smith, S. H. Roberts.

Pistons, &c.—J. W. Preston (com.), J. W. Preston (com.). W. Lawson, J. Wills.

Presses, Compressing, &c. — W. E. Gedge (com.), S. H. Johnson, W. Barker.

Printing and Transferring: Type and other Surfaces for Printing, Composing, and Distributing Type.—P. D. Hedderwick, C. J. Squintani.

Propelling Machinery, Transmitting Power, and Motion, Converting Movements.—G. W. von Nawrocki (com.), J. Shepherd, J. T. Abell.

Propelling Ships, Propellors, Paddle-wheels and Screws.—R. Thompson, J. L. Corbett and W. Lockhead.

Pumps, Pumping and Raising Water and other Liquids, Pumps, Pistons, and Packing.—J. Clark, W. C. Edwards and M. Stobbs, J. Wills, W. Oliver.

Punching or Perforating.—A. C. Henderson (com.)

Railway and Similar Buffers.—H. Statham.

Railway, Permanent Way, Rail Joints, Chairs and Sleepers, Portable Railways, Atmospheric Railways, Switches, Points, Crossings, and Turn-tables.—S. J. V. Day (com.), W. Morris, J. Seddon, G. Webb, C. Bergeron.

Railways, Carriages, Coupling, Uncoupling, and Altering Position of Carriages and Engines.—T. Floyd and W. Hunt, T. Clarke, H. J. Haddan (com.)

Registering, &c.—F. Marley, A. J. Aspinall, T. and H. Green, J. Hope, H. C. Symons.

Respirators, &c.—R. Jenkins.

Roads, Paths, &c., J. Lindsay, E. H. Bayley, J. Mitchell.

Screens.—G. E. Vaughan (com.), J. Totton.

Screws, Screw Drivers, &c.—W. Morgan Brown (com.)

Sewing and embroidering.—A. C. Henderson (com.)

Shears, &c.—D. Ward and T. Birkhead.

Ship and Boatbuilding.—W. R. Lake (com.)

Ships' Cargoes, Ships' Boats (Lowering, &c.)—J. Mackenzie, J. H. Barry.

Shot, Shell, Bullets, Cartridges, Percussion Caps, &c.—T. Hitt, C. Piper (com.)

Show Cases, &c.—W. P. Thompson (com.), A. Coates, W. Taylor and H. A. Ridsdale.

Sifting, Sorting, and Separating.—C. Armstrong.

Signals, Alarms, Communicating Apparatus, &c.—W. Simpson (com.), J. H. Johnson (com.), St. J. V. Day (com),, H. Morris, C. O. Ramstedt, W. P. Thompson, H. Symons, A. M. Howarth.

Sounds (Reproducing, &c.)—W. R. Lake (com.), L. J. Crossley.

Spinning and Preparing for Spinning.—E. J. J. Leconer and J. M. Hetherington, E. d. Pass (com.), H. Sincon (com.), J. Bastow and W. Woodhead, J. Farrar, J. and H. Law, J. Gledhill and W. Cliff, J. Aked.

Springs.—G. von Nawrocki (com.), S. Boarland, H. Carey.

Stacking Crops, &c.—E. P. Plenty.

Sleam and other Boilers, Cleaning and Preventing Incrustation of Boilers, Water Feeding Apparatus for Boilers.—W. R. Lake (com.), W. E. Gedge (com.), B. Harlow, L. Perkins and W. W. Harris, W. P. Thompson (com.), T. Jones, T. Jones, J. Henderson.

Steam Engines (Stationary, Locomotive, and Marine).—P. Jeusen (com.), J. D. Lorsen. J. C. Stevenson and J. B. Price, L. Perkins and W. W. Harris, J. T. Abell, W. Oliver.

Steering Ships and Boats.—M. Nordmann, W. B. Thompson, J. L. Corbett and W. Lochhead.

Stuffing boxes, glands.—J. Wills.

Sugar and Syrups Glucose.—D. Mac Eachren J. H. Johnson (com.), J. H. Johnson (com.), J. N. Todd, A. Fryer.

Swimming, &c.—W. C. Brown.

Telegraphs; Telegraph Printing Apparatus.—W. C. Brown, W. R. Lake (com.), L. J. Crossley.

Thimbles.—W. Pursall.

Threads, &c.—D. S. Bles, G. Gledhill and W. Cliffe.

Tilling and Cultivating, &c.—R. A. and B. Edwards.

Tobacco and Snuff, Cigars, Cigar-Holders, Pipe and Cigar-lighters, Smoking Pipes, Tobacco Pouches, &c.—M. Friedlander.

Tramways and Tramway Carriages, Tramway, Locomotives.—B. Jno. Mills (com.), T. Floyd and W. Hunt, N. P. Burgh, W. Morris.

Trimmings, &c.—A. Coates.

Tunnels, &c.—J. Clark.

Turning, Lathes for Turning.—A. Wright and W. Jones.

Umbrellas, Parasols, &c.—A. MacMillan, E. Restran and W. W. Stead, G. W. von Nawrocki (com.)

Upholstery.—H. Carey, E. F. Redfern (com.)

Urinals.—F. Wirth (com.)

Valves, Taps, Stop Cocks, Plugs; Regulating the Flow and Pressure of Fluids.—A. M. Clark (com.), W. E. Gedge (com.), W. C. Edwards and M. Stobbs, W. R. Lake (com.), G. Grant.

Vtlocipedes, Bicycles, &c.—G. W. Perris, J. Bonner, T. Warwick.

Ventitation: Supplying and Purifying Air for Buildings, Mines, Ships, Carriages, &c.—G. L. Scott and S. Hallam, T. Jones.

Voting, &c.—H. C. Simons.

Washing, Cleansing, and Wringing Fabrics, Yarns, and Materials.—C. Griffiths (com.)

Waterproofing, &c.—R. Condy.

Water-Closets, &c.—G. Grant.

Watering and irrigating, &c.—E. H. Bayley.

Water-power Engines, &c.—P. Jeusen (com.), J. P. Lambert and L. E. Iverneau, J. L. Corbett and W. Lochhead.

Wax.—W. R. Lake (com.)

Wearing Apparel, &c.—W. H. Chase (com.)

Weaving, Braiding, Plaiting, Preparing for Weaving.—R Meddows, G. Ambler, R. S. E. and R. Collinge, W. H. Holmes, G. Keighley.

Windowblinds, &c.—J. Rettie.

Windows and Sashes.—J. Totton, J. Rettie.

Wire, Wire Working, &c.—J. and H. Law.

Zinc.—R. A. Fisher, R. A. Fisher.

*** *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

Correspondence.

LUMINOUS PAINTS.

TO THE EDITOR OF THE SCIENTIFIC AND LITERARY REVIEW.

Sir,—I am making experiments at the present moment directed to the manufacture of luminous paints, with a view to determining the possible amount of light to be obtained from such phosphorescent compounds, to be used as a means of illumination in the place of other artificial illuminants. When I have completed my experiments I shall be happy to describe them in the Scientific Review.

Frank Scott

London, E., Jan. 29, 1880.

Reviews.

HON. H. CAVENDISH.

"The Electrical Researches of the Honourable Henry Cavendish, F.R.S." Written between 1771 and 1781; edited from the original manuscripts, in the possession of the Duke of Devonshire, K.G., by J. Clerk Maxwell, F.R.S. Cambridge: University Press.

The Hon. H. Cavendish was one of those singular beings occasionally met with in this world of ours; his peculiarities appear to have been such as make him stand out in bold contrast to nearly all others workers in science; for, as our able contemporary, the *Journal of Science*, remarks:—Every discoverer, now-a-days (we would apply the statement that follows to most discoverers of former days), whether great or small, as soon as he finds his light—whether it be a six-thousand-candle electric lamp or only a halfpenny dip—immediately hastens to place it on the top of the tallest hill he can find, so that it may shine forth literally *urbi et orbi*. Many lights, it is true, give forth only a feeble glimmer; but it is surely better that we should be at times overburdened with crude observations of possibly valueless facts, than that a single particle of truth should be concealed, or its publication delayed even for a day more than is absolutely necessary.

An important discovery in any branch of physical science is now made public with a rapidity that has never before been equalled, and the paper, article, or even telegram containing its history is published and re-published, discussed and criticised, in every civilised language. The observations described are repeated and tested in half a hundred laboratories, and the slightest incorrectness or mis-statement is pounced upon with the utmost eagerness, and published with the same universality as the original researches themselves. The numerous facilities which we possess for spreading and sifting scientific observations are bearing fruit every day, and the scientific press—although its office is to collect and distribute facts rather than to criticise them—has become as great a power in its own particular sphere as its elder sister, the political press, has in the hands of our political fellow-workers.

As regards Cavendish, who stands so eminent in regard to physics and chemistry, he was the eldest son of Lord Charles Cavendish, third son of William, second Duke of Devonshire. And it appears that during his father's lifetime he was kept in rather narrow circumstances, being allowed an annuity of £500 only, while his apartments were a set of stables, fitted up for his accommodation. It was during this period that he acquired those habits of economy and those singular oddities of character which he exhibited ever after in so striking a manner.

The great peculiarity of Cavendish seems to have been his thoroughly undemonstrative character. As to this the Editor states:—

"Cavendish cared more for investigation than for publication. He would undertake the most laborious researches in order to clear up a difficulty which no one but himself could appreciate, or was even aware of, and we cannot doubt that the result of his inquiries, when successful, gave him a certain degree of satisfaction. But it did not excite in him that desire to communicate the discovery to others which, in the case of ordinary men of science, generally ensures the publication of their results. How completely these researches of Cavendish remained unknown to other men of science, is shown by the external history of electricity."

As regards the "researches" which Prof. Maxwell has disinterred, we may quote the the following:—

"He shows that when two charged conductors are connected by a wire they must be electrified in the same degree, and he devotes the greater part of his experimental work to the comparison of the charges of the two bodies when equally electrified. He ascertained by a well-arranged series of experiments the ratios of the charges of a great number of bodies to that of a sphere 12·1 inches in diameter, and as he had already proved that the charges of similar bodies are in the ratio of their linear dimensions, he expressed the charge of any given body in terms of the diameter of the sphere, which, when equally electrified, would have an equal charge, so that when in his private journals he speaks of the charge of a body as being so many 'globular inches,' or, more briefly, so many 'inches of electricity,' he means that the capacity of the body is equal to that of a sphere whose diameter is that number of inches."

"In his early experiments he seems to have endeavoured to obtain a number of conductors as different as possible in form, of which the capacities should be nearly equal. Thus we find him comparing a pasteboard circle of 19·4 inches in diameter with his globe of 12·1 inches in diameter, but, finding the charge of the circle greater than that of the globe, he ever after uses a circle of tin plate, 18·5 inches in diameter, the capacity of which he found more nearly equal to that of the globe."

"He also provided himself with a set of glass plates coated with circles of tin-foil on both sides. These plates formed three sets of three of equal capacity, the capacities of the three sets being as 1, 3, and 9, with a tenth coated plate whose capacity was as 27. Besides these he had 'double' plates of very small capacity, made of two plates of glass stuck together, and also other plates of wax and rosin, the inductive capacity of these substances being, as he already found, less than that of glass; and jars of larger capacity, ranging up to his great battery of forty-nine jars, whose capacity was 321,000 'inches of electricity.' In estimating the capacity of his battery he used the method of repeated touching with a body of small capacity."

"We have next to consider the steps by which he established the accuracy of his theory."

"The first experiment is that of the globe within two hemispheres, from which he proves that the electric force varies inversely as the square of the distance, or at least cannot differ from that ratio by more than a fiftieth part. The degree of accuracy of all the experiments was limited by the sensitiveness of the pith ball electrometer which he used."

"The third experiment shows that in comparing the charges of bodies, the place where the connecting wire touches the body, and the form of the connecting wire itself, are matters of indifference."

"The fourth experiment shows that the charges of bodies of the same shape and size, but of different substances, are equal."

". . . . . The observed charges of coated plates were found to be always several times greater than the charges computed from their thickness and the area of their coatings, the ratio of the observed change to the computed charge being for plate glass about 8 2, for crown glass about 8·5, for shellac about 4·47, and for beeswax about 3·5. Thus Cavendish not only anticipated Faraday's discovery of the specific inductive capacity of different substances, but measured its numerical value in several substances."

"The accuracy which Cavendish attained in the discrimination of the intensity of shocks is truly marvellous, whether we judge by the consistency of his results with each other, or whether we compare them with the latest results obtained with the aid of the galvanometer, and with all the precautions which experience has shown to be necessary in measuring the resistance of electrolytes."

These quotations will afford the reader a good idea of the contents of this work, the publication of which was quickly followed by the decease of its lamented editor. It is well worthy of perusal by every man of science.

REVIEWS POSTPONED.

Reviews of the following works, which we deem worthy of favourable notice, we are compelled by pressure of other matter to postpone, viz., "Hot Air *versus* Hot Water Baths for the Working Classes," by Richard Metcalfe; "William Daniels, Artist," by William Tirebuck; "Notes of a Journey to the Auriferous Quartz Regions of Southern India, with Facts Relating Thereto," by A. Hay Anderson (Blackwoods). Several other works were received too late for review in our present issue.

THE ELECTRIC LIGHT IN THE CITY.

The premises of Messrs. Samuel Brothers, merchant tailors, Sydenham House, 65, and 67, Ludgate-hill, in the City of London, have been fitted up with the electric light, and the inaugration of the lighting took place on the evening of the January 14th, in the presence of a large number of gentlemen interested in the question of electric lighting, representatives of the press, &c.

The premises are lighted by means of 13 electric lamps of the Jablochkoff system, and are distributed as follows:—One in each of the two windows on each side of the principal entrance in Ludgate-hill; two in the front of the ground floor; two in the back of the ground floor; one in the counting-house; one over the landing of the large staircase leading to the upper floor; three in the juvenile and ladies' department on the first floor; two in the gentlemen's bespoke department on the first floor.

The lamps are all suspended from the ceiling, at a distance of about eight feet from the floor, and by means of harp pendants, through which the conducting wires are conveyed to the candles. They are made to contain four Jablochkoff candles, and as each candle lasts two hours a continuous light for eight hours is therefore provided. The lamps can easily be replenished when the last candle is burning, so that, practically speaking, the light can be made to be continuous for any length of time. The globes are of the opalescent description, and twenty inches in diameter.

The currents of electricity are produced by a battery of Gramme Patent Dynamo Electric Machines of the twenty light size; the battery being composed, as is well known now, of a small Gramme continuous current distributing machine. The large machine is divided into four circuits, capable of maintaining five lights each. In the existing arrangement three circuits only of the distributing machine are utilized, two maintaining four lights each, and one maintaining five lights. An additional lamp was temporarily added to that number, and was kept burning in the engine-room, which it lighted admirably.

The lights are arranged so as to be all switched from a switch board placed at one of the cashier's desks on the ground floor. This arrangement is an important feature, and the switching was shown in operation. The motive power for working the electric machines is obtained from a twelve horse-power "Otto" gas engine, made by Messrs. Crossley Brothers, of Queen Victoria-street, London.

This gas engine, like the electric light itself, is one of the most remarkable and important inventions of the nineteenth century.

It is made in sizes, with a single cylinder from one-half to forty indicated horse-power. By using a double cylinder the power can be increased to one-hundred horse-power. There being no boiler, all risk of a boiler explosion is removed, which allows this engine to be used where steam is inadmissible. As there is no risk of fire, the rate of insurance is not affected by the presence of an "Otto" gas engine. There are no coals to get in or store, or ashes to remove. There is no smoke, consequently the neighbourhood is not disfigured by a high chimney with its cloud of dirty smoke, and the owner is not annoyed by visits of the inspector of nuisances. The "Otto" gas engine is always ready to start at a moment's notice on lighting a jet of gas and turning the fly wheel, there being no delay till steam is raised as in the case of a special steam engine. By dispensing with the boiler, the boiler attendant's wages are saved; in fact, this gas engine offers all the advantages of a steam engine without any of the accompanying disadvantages of having a steam boiler on the premises. Economically speaking, the gas engine is cheaper to work than a steam engine, especially when the work is intermittent; it is, therefore, no matter of surprise that the "Otto" gas engine is rapidly replacing steam engines in all places where a supply of gas is available. It is within the mark to say that this engine is taking the placs of steam at the rate of twenty-five engines a week, a fact that should go a long way to reassure holders of gas stock.

The Gramme Machine is driven directly by means of suitable pulleys fixed on the shaft of the engine, the small one, or excitor, running at a speed of 620 revolutions, and the large one, or distributor, at a speed of 688 revolutions per minute. They are together with the gas engine erected in a room situated in the basement at the back of the building.

The whole mechanical and electric plant which have been fixed and fitted up, under the immediate supervision of Mr. J. A. Berly, C.E., the engineer to the Société Génerale d'Electricité, are erected in a most substantial manner.

From an experiment made by Mr. Berly and Mr. Wilson, C.E., the London representative of the firm of Messrs. Brossley Brothers, a number of lights equal to twenty have been maintained by the gas engine, and there is no doubt that a larger number could be maintained after the plant has been in operation during a certain period, as the stiffness with which all new machines work will gradually disappear and the producing qualities of the Gramme machines will gradually improve.

This is the first time, in this country as well as in France, that a large number of Jablochkoff lights have been worked from a gas engine, and Messrs. Samuel Brothers deserve great credit for the enterprising spirit which they have shown, in adopting for their splendid establishment this mode of illumination which is now steadily making its way ahead, and will, in all probability, be generally adopted within a very limited period.

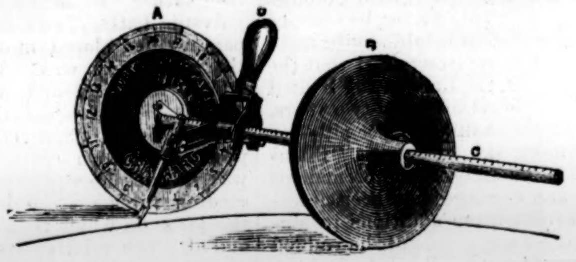
On visiting the bespoke and ladies' department of Messrs. Samuel Brothers premises, we could at once appreciate the immense advantage that the purchasing public would derive from the general adoption of the electric light.

On examination of some ladies' costume cloths, gentleman's suitings, &c., we found that the most delicate colourings and tints were as distinctly discernible as if viewed by daylight.

Amongst the persons present at the inauguration of the lighting of Messrs. Samuel Brothers premises were, Mr. J. Gaudet, the managing director of the Socièté Génerale in England, &c.

THE GRAPHARC.

THIS instrument, the invention of Mr. Thomas P. Worthington, architect, of Blackpool, is designed to describe circles or arcs of circles of large radii in limited workshops or other places where the length of radius cannot be got. It will also describe arcs of small radii, say from four feet upwards, more expeditiously than by the usual method.



There are two wheels, axis or spindle, distinctly graduated for feet and inches radius and a propelling handle with marker or pencil., The larger wheel is marked A, the other B, the spindle C, and handle with marker D.

It will at once be seen that the two wheels form the frustrum of a cone whose unseen apex is (when this frustrum is rolled) the centre of the circle or arc described by the larger wheel. It will also be seen that by placing the wheels nearer together the apex or centre is also nearer, and by putting them further apart the centre is further away.

The principle of the invention is thus explained, but to bring the principle to be of use it was necessary that the wheels should be in known ratio one to the other, and that the axis should be graduated to suit, so that the draughtsman could at once set the wheels at such distance apart as would give him the curve of radius required.

The inventor found that by having the diameter of the lesser wheel exactly one proportion less than that of the larger one, and these proportions known, that the graduation of the axis per foot radius was exactly the fraction of an inch (for English measures) having the proportional number of the larger wheel as the denominator, and twelve as the numerator, thus :—

Proportion of diameters of wheels. Large wheel.		Small wheel.	Graduation of axis per foot radius.
2	and	1	12-2 or 6".
5	,,	4	12-5
10	,,	9	12-10
20	,,	19	12-20 of an inch.
40	,,	39	12-40 ,,
1000	,,	999	12-1000 ,,
1200	,,	1199	12-1200 ,,

and so on.

From this list of proportions and graduations, it will be at once seen that the range of radii is practically only limited by the ability to manufacture the instrument, which there is no doubt would be rather difficult in the higher proportions if the wheels were required of small size, but so long as the proportional difference is right, the wheels may be of any size desired, and this without making any difference with the graduations for these proportions.

For curves up to 50 feet radius the larger wheel need not be over 2½ inch diameter, and proportioned to 50 parts, and the lesser wheel one part less in diameter, or 49; this would require axis graduated to 12" long with graduations 12-50 of an inch apart, these representing feet radius of curve which the large wheel will run when wheels are adjusted. It is obvious that with this instrument a less radius than 10 feet could not with steadiness and certainty be described, as for this the wheels would be but 1-5th of a foot apart, but any radius could be used with this instrument between 10 feet and 50 feet.

For larger curves larger instruments would be required; for instance, take one to describe curves of from 2000 to 10,000 feet radius. The larger wheel in this would of necessity have to be of considerable size to make the proportional difference with accuracy, as the proportions would not well do less than 1000 for large wheel and 999 for lesser one, and with these proportions the axis would require to be 10 feet long. For an instrument of this range I should propose the larger wheel of near 3 feet in diameter, and with this the lesser wheel would but differ in diameter by about 1-28th of an inch.

Curves of the largest or least radius (within the range of the instrument) can be drawn with equal facility and dispatch, and with same limited space. An arrangement of the same patent is prepared for the purpose of the perspective draughtsman, for use in getting all his radial lines to either vanishing point without the long straightedge or centro-lineal.

ENGINEERING PAST AND PRESENT.

By MR. W. H. BARLOW, F.R.S., President of the Institution of Civil Engineers.

THE following is the official abstract of the presidential address of Mr. W. H. Barlow (who, it may be right to state, is one of the original members of the Inventors' Institute, and a member of its Council), delivered at the first ordinary meeting after the Christmas recess, held on Tuesday, the 13th of January, which will be found to afford a concise view of engineering past and present:—It stated that his professional career having commenced in 1828, the same year as that in which the institution had received its royal charter, he proposed to draw attention to the great changes and progress in engineering which had arisen since that time. Undeniably, the influences that had mainly operated on the well-being of this kingdom, and on the world at large, were the improvements in the means of communication, by the application of steam to locomotion on land and on sea, and by the utilization of some of the powers of electricity in the transmission of intelligence.

For some time previous to 1828, an improvement had been urgently demanded in the means of transport for goods and minerals. The canals were estimated, in 1836, to exceed 3,000 miles in length; but they were wholly inadequate to the wants of the commercial interest at that time. Much attention was bestowed on turnpike roads, many of the main lines having been brought to a high degree of excellence by Thomas Telford, the first president of the institution. Tramways, which existed long before canals and in considerable numbers in the mineral districts, were mostly of cast iron, and belonged to private owners, few being applied to the general purposes of commerce. There were also some railways, distinguished from tramways, as their name implied, by being formed of rails instead of tram-plates; among which was the well-known Stockton and Darlington Railway. The application of steam in locomotive engines was in an early experimental stage; and the labours of George Stephenson, in connection with the Liverpool and Manchester Railway, formed the starting point of that great railway system which had spread its network and its ramifications in many parts of the world. The system thus inaugurated in 1830 was estimated, in 1875, to have reached 160,000 miles in length, the capital invested in their construction having been 3,200 millions sterling. Since then there had been considerable extensions; and when it was remembered that China had at present no railways, that Japan was only beginning to construct them, that Africa, with a population of between 350 and 400 millions, was almost without railways, as well as a large part of South America and Central Asia, and that the British Colonies were still badly provided, it must be obvious that the railway system would continue to increase. It had been ascertained that the traffic growth on all the lines in the United Kingdom, over a period of thirty-two years, had averaged more than £100 per mile per annum. To meet the exigencies of this increase, a reconstruction of the permanent way, engines, and carriages had been necessary, as well as extensive additions to stations. While these improvements had added much to the comfort of railway travelling, a complete system of block-signalling, the employment of continuous brakes, and the interlocking of points and signals, had greatly increased the safety, notwithstanding the higher speed, and the greater number of trains. The recent most lamentable and unprecedented accident at the Tay bridge was at present the subject of a searching investigation, which it might be hoped would reveal the probable cause or causes that had contributed to such distressing results, and thus afford information of the greatest value for future guidance.

The limited number of steam vessels existing in 1828 were chiefly employed in river and coasting traffic. At that time all ships, including ships of war, were of timber. Ocean steam navigation had not been attempted, the starting point of which might be said to have been the almost simultaneous voyages of the "Sirius" and the "Great Western," in 1838. Its commercial success and the extent to which it had been carried, were owing to improvements which involved a greater range of scientific knowledge than the constauction of railways, and were due to deep thought and unremitting perseverance. By improvements in the marine-engine, the consumption of fuel had been largely reduced; the screw propeller had taken the placs of the paddle-wheel, by which greater advantages in propulsion had been obtained; and the substitution of iron and steel for timber in the construction of ships, combined with a better knowledge of their forms and lines (the latter owing mainly to the valuable researches of the late William Froude), had enabled vessels to be made of much greater strength and carrying capacity.

The extension of ocean navigation had rendered necessary a great increase in dock and harbour works, several of which were alluded to; but the number of wrecks that occurred annually within British waters, seemed to show that more harbours of refuge were required on the coasts of the United Kingdom, while there was evidence that the development of steam navigation was impeded by an insufficiency of harbours. This was especially observable in regard to the communication between England and France. It was satisfactory to learn that the French Government was about to improve the harbours on the coast of France, and it was hoped that this would be followed by corresponding action on the part of the English Government.

The introduction of electricity for the purposes of telegraphy, and more recently for the production of light, and lastly, for the transmission of power, was a matter of special interest, as being one in which the labours of the philosopher, and the discoveries originating in his laboratory, were made directly serviceable "for the use and convenience of man." As in many other discoveries and new applications of science, the form which the telegraph ultimately received in the hands of Sir Charles Wheatstone and Sir William Fothergill Cooke, and its use to signalling on the Blackwall Railway in 1838, had been preceded by various suggestions showing the conception of the idea. Sir Francis Ronalds made a telegraph worked by frastional electricity, of which he published an account in 1823. A much nearer approach to the needle telegraph was an experiment by the late Professor Barlow (the father of the President), who used a galvanic battery, and deflected small compass needles placed in different parts along the conducting wire. By this experiment, which was recorded in the *Edinburgh Philosophical Journal* for 1825, Professor Barlow found that considerable loss of power arose with increase of length, and he was in consequence discouraged from proceeding further than determining some of the laws on which that decrease depended, and also the relative conductivities of different sizes of brass or copper wise. The large-quantity battery that had been employed in his experiments on electro-magnetism was used without any coil. and the wires were hung to the posts without any insulation. In 1875, the total length of wire in operation was estimated at 400,000 miles. Since then the Eastern Telegraph Company had extended its lines to the Cape of Good Hope; two new cables had been laid between France and America, and large extensions and duplications of land lines had been made. There were no means of tracing the traffic growth of telegraphy; but by the introduction of the duplex system and the automatic working, together with other ingenious contrivances, the traffic must have increased in a far greater proportion than the length of wire in operation. The diminution of power, arising from increase of length in the conducting wire, had been surmounted by relays of power applied at fixed stations. By employing this ingenious expedient on the Indo-European Telegraph, Calcutta had frequently been put in direct communication with London, a distance of 7,000 miles. Another application of the telegraph, now commencing in this country, but already in considerable use in America, was the telephone, first publicly exhibited by Professor Bell at the Philadelphia Exhibition in 1876. The power of transmitting the sound of the human voice and its articulation, gave it a high scientific interest. Its value as a commercial instrument consisted in saving the time required to write, transmit, and re-write telegrams. The more recent electro-dynamic machines had placed lighting by electricity on a totally different footing to that on which it formerly stood, and left no doubt of its applicability to many important purposes. It was, in fact, already established in lighthouses, where its intensity and power were of the highest value, and there were many examples of its application in public buildings and large shops, in railway stations and open spaces, and for street lighting. Whether it could be divided, so as to become equally economical and convenient for domestic purposes, had yet to be ascertained. The distinction between the intensity of light and its illuminating power ought not to be overlooked. The intensity of a light bore the same kind of relation to its illuminating power as the specific gravity of a substance did to its weight. The latest application of electricity, namely, for the transmission of mechanical energy, was suggested by Dr. C. William Siemens, who had ascertained that, including all sources of light, 50 per cent of the original power could be realised at a distance of one mile, and that, with adequate provisions against heating, it would be no dearer to transmit electro-motive power to a greater than to a smaller distance. Sir William Armstrong had availed himself of this force for working a circular saw placed at a distance of one mile from the waterfall which supplied the floor. The deep sea sounding-line on board the telegraph ship "Faraday" was hoisted by mechanical energy thus transmitted from the engine; and Dr. Werner Siemens had succeeded in obtaining locomotive power sufficient to convey thirty persons by similar means.

By the action of the City of London, and at a later period of the Metropolitan Board of Works, the condition of the metropolis has been greatly improved. But during the last fifty years the only additional public communications made across the Thames, within the active metropolitan area, were the Hungerford Suspension Bridge, since removed and replaced by the public footway in connection with the Charing Cross Railway Bridge, and the Lambeth Bridge and the Tower Subway, the two latter constructed by Mr. Peter W. Barlow. The extensive increase of traffic in the more commercial part of the metropolis, produced such great difficulties at London Bridge, that some other road communication to the eastward of that bridge could not much longer be delayed.

The employment of gas as a means of illumination, which was in its infancy in 1828, had increased in a remarkable degree. The capital invested in gas-works, in the United Kingdom, was £40,000,000, of which about £12,000,000 represented the capital of the London Gas Companies. At the end of 1878, the length of gas mains in the metropolis was 2,500 miles, and there were about 58,000 public lamps for street lighting. In the same year the quantity of coal decarbonized was 1,715,000 tons, which produced nearly 17,500 million cubic feet of gas, besides residual products of the value of £745,000. The coal used was about four-tenths of a ton per annum per head of the population. Of the gross revenue 5 per cent was derived from street lighting, 20 per cent arose from the sale of residual products, and 75 per cent from private consumers.

The application of wrought iron in the superstructure of engineering works having been touched upon, the president remarked that the improvements effected in the manufacture of steel assumed the character of new discoveries, which were tending to revolutionise the iron industries of the world. The inventions of Sir Henry Bessemer, followed by those of Dr. C. W. Siemens, and Mr. Martin, had led to this change. Besides the advantages which steel had over iron for rails, wheel tyres, and structural purposes, there was a general gain to the community arising from the smaller quantity of coal required for its production. Thus, to make a ton of iron about six tons of coal were necessary, but to make a ton of steel three tons of coal sufficed. The production of modern steel was a subject which the president had followed from its commencement with great interest. A committee of engineers, of which he was a member, had made an extended series of experiments on steel, and the subject had been referred by the Board of Trade to Sir John Hawkshaw, Colonel Yolland, and the president. This resulted in the adoption of a co-efficient for steel of 6½ tons to the inch, that of iron being five tons; it being understood that for steel of high qualities the co-efficient should be raised by agreement, due precautions being observed in the testing. Although enough was known about steel for ordinary structural purposes, there were properties belonging to that material which greatly needed further experimental enquiry. Untempered steel was very like good iron in two of its characteristics. First, it possessed nearly the same modulus of elasticity; and, scondly, the force required to extend it to the limit of its elasticity, or the force at which an appreciable permanent set first appeared, was about one-half that required to cause rupture. The superior strength of untempered steel over that of good wrought iron was proportionate to the greater range of its elastic action; and the ratio which this greater range of elastic action bore to that of iron varied with different qualities of steel. But the strength of steel might be greatly improved by tempering in oil, a process now much in use. Experiments were wanting to determine what change, if any, arose in the specific gravity of the metal when under strain within its limit of elastic action. Within certain limits the stretching, either of iron or of steel, beyond its original elastic limit increased the strength and the range of elastic action. The process of cold rolling was an example of this effect; and steel wire, drawn cold, exhibited remarkable strength—that employed by Sir Wiliam Thomson in his deep-sea soundings having borne 149 tons to the inch. One of the most striking applications of the hydraulic press was that introduced by Sir Joseph Whitworth by which large ingots of molten metal were subjected to a pressure of six or seven tons per inch, and the ingot thus rendered perfectly solid and sound. At the same works, the hammer was dispensed with in large forgings of steel, the red-hot metal being pressed into the required form by the hydraulic press.

In the early days of the institution, the laws which governed mechanical action and forces, and the strength of materials, were very imperfectly understood. In the interval the great advances in practice had been accompanied by a marked extension in an accurate knowledge of the physical sciences. Obviously it was most essential that engineers should be acquainted with the principles which lay at the foundation of mechanical science, and with the nature and properties of the materials employed in works. It was, therefore, satisfactory to find that many colleges now had special departments for imparting instruction in applied science, and the increasing area of scientific requirements rendered it desirable that a yet wider field should be given to that class of education. In conclusion, the president expressed indebtedness to those men, both within and without the profession, in foreign countries as well as in this, who by study and experimental research were continually adding to an exact knowledge of the great sources of power in nature—that power, the direction of which to the use and convenience of man, constituted the fundamental element in the charter of the Institution of Civil Engineers.

RAILWAY CARRIAGE LIGHTING.

Although great progress has been made of late years towards the efficient lighting of railway carriages by the introduction of gas for that purpose, it would appear that there is still room for improvement, especially in the illumining of carriages with gas for long journeys. For short journeys ordinary coal gas answers to a certain extent on the metropoliton lines of railway, but there is the objection that the reservoirs on the carriages have to be replenished many times during the day. On the Great Eastern and the Metropolitan lines of railway a system of carriage-lighting, by means of an oil-gas used under pressure, has been for some time in partial operation, but we are not aware that this system has as yet been applied to long-journey and express trains. The Great Northern Railway Company, however, are now affording facilities for testing a new kind of enriched gas, placed under compression, which, so far as at present experiments have shown, appears to fulfil all the necessary conditions required of a railway carriage light, especially those of brilliancy, steadiness, permanency under extremely low temperatures, and adabtability to long journeys. The illuminant consists of ordinary coal gas of 16-candle illuminating power, enriched with hydro-carbons under the influence of heat. Ordinary London gas is composed of about 94 per cent of hydrogen and marsh gas and 6 per cent of hydro-carbon gases. The properties of the hydrogen and marsh gases are rather heat-producing than light-giving, so that the light-giving power is mainly due to the small percentage of the hydro-carbon gases present in the bulk. One of the richest of these latter gases is naphthalene, which, however, will of itself, under certain conditions, solidify, separate from the gas, and become deposited in the form of crystals, thus depriving the gas of the benefits of its presence as an illuminant. By the addition, however, of certain other hydro-carbons it is found that the solidification of this napthalene is prevented, and its retention insured in the bulk of the gas in the gaseous form. It is thus rendered available, together with the additional hydre-carbon gases, for raising the illuminating power of ordinary coal gas to a very high standard.

The method of effecting this transformation is the subject of a patent which has been taken out by Mr. William Sugg, of Westminster, in conjunction with Mr. F. W. Clark. In practice the hydro-carbon illuminants are supplied to the ordinary gas at such a temperature as to prevent the deposition of the naphthalene which always occurs in cold weather. These extra illuminants are obtained either from naptha or light petroleum oils. The hydrogen and marsh gases in the coal gas have a great affinity for the rich hydro-carbons of which they absorb a certain definite quantity which they retain permanently after being subjected in combination to a temperature of from 600 to 800 deg. Fahrenheit. The ordinary gas thus highly enriched passes on its way from the commingling apparatus to a gas-holder or receiver, in which it is stored for use under a pressure of about 120lb. per square inch. In this way the ordinary 16-candle gas becomes transformed into 40-candle gas, its illuminating power being thus more than doubled in proportion to its bulk. The practical application of this principle has been taken up by Mr. T. C. Hersey, on the part of the Gas Light and Coke Company, of which he is the chief inspector, and the experiments are being carried out at the company's expense. One of their gas stations adjoins the Great Northern Railway at King's Cross, and there the necessary apparatus for the manufacture of the enriched gas has been erected and is working under the charge of Mr. John Clark. The method of production was recently inspected by us as well as the results of its use in one of the Great Northern Railway carriages. Upon the matter being introduced to Mr. Oakley, the superintendent of the railway, that gentleman at once directed a carriage to be fitted with the lamps and necessary apparatus, which were designed and applied by Mr. Sugg. The apparatus consists of four iron store-cylinders, or reservoirs, each 15ft. long and 8in. in diameter, and placed on the roof of the carriage. From these reservoirs small pipes convey the gas to the lamps, which are fitted with governors, and supplied with the necessary arrangements for controlling and economising the supply of gas. The lamps are of nickel silver and very ornamental in appearance the rim around them being perforated and forming an efficient ventilator for each compartment. The vitiated air is drawn off by the induced current caused by the lamp flame and escapes by way of the roof. The supply of gas to the carriage is conducted from the adjacent gas works by a pipe laid underground to the railway platform, the connection for the supply to the carriage being made by means of a flexible hose. The gas is stored under a pressure of from 50lb. to 70lb. per square inch in the reservoirs, and such is the durability of this small bulk that the carriage has made the journey to Leeds and back with one charge of gas, the lamps in each of the four compartments being kept burning all the time. The journey has been several times repeated with the same results, and during the late severe weather, several inches of snow on the roof failing to affect the gas in any way. The gas, in fact, has been allowed to remain in the reservoirs on the carriage for a week exposed to the cold, without any condensation or deterioration occurring.

Such has been the success of the first practical application of this system to railway carriage lighting that Mr. Oakley has directed another carriage to be fitted by Mr. Sugg, and in this one some improvements in minor details suggested by experienec are being introduced. This carriage is to make the journey through to Aberdeen with one charge of gas. Should this succeed—and there appears to be no reason why it should not—the further, if not the general, application of this system may be looked for on the Great Northern Railway. This may, perhaps, lead to its adoption on other lines where the oil lamp is still in use, as a railway company has only to take a supply of ordinary coal gas from any convenient point at which it is used on their line and enrich and supply it to their carriages themselves. This can be done at a comparatively small cast, and with apparently the most satisfactory results, for which the travelling public will greatly thank them.

AMITIÉ.

Tho' absent, thou art not forgot,
  Thy spirit cheers me still;
Illumes the same, tho' thou art not,
  The same my senses fill!
Lives not the lily pure and true,
  Tho' winter winds may blow,
In spring to breathe to life anew,
  When fades the frozen snow?

The time that parts us may give pain;
  If pain brings peace to me,
It is to feel it is not vain:
  That friendship's bound in thee!
When once the ivy's twined the bower,
  The closer still it clings!
When shines the sunlight thro' the shower,
  The songster sweeter sings!

Oh! may the new year coming make
  A ring of golden hours,
And happy be for thy dear sake:
  A fountain 'mid fair flowers!
Bright gems there are which ever shine;
  But one's unseen to-day,
That I would greet in sparkling wine,
  And nurse in love for aye!

Henry George Hellon.

31st December, 1879.

Grapharo.—We are requested to state that a specimen of this instrument (described in another column), can be inspected at the Inventors' Patentright Office, 21, Cockspur Street.

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Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President, SIR ANTONIO BRADY.

THE SESSION 1879—1880

Members' Meetings will be held at 8.15 p.m. on Thursdays, February 5th and 26th. March 11th and 25th; April 8th and 22nd; May 6th; and June 3rd.

At the meeting on the 5th February, "The Patent Law Reform Question."

On 26th February "On Brilliancy in Lighting," specially with reference to the use and misuse of the Lime Light, by J. Cadett, Esq. Illustrative experiments will be given with this paper.

Annual General Meeting, Thursday, May 20th, at 4 p.m., unless otherwise arranged.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

MEMBERS' MEETINGS.

On January 8th Mr. F. W. CAMPIN read his paper on the Present Position of Electric Lighting. It was one of considerable length, and is published in another column. There was not much discussion. Mr. Greenfield moved the vote of thanks to Mr. Campin for his paper, and Mr. Morgan seconded the vote, which was passed unanimously.

On January 22nd Mr. Purdey's paper on Miners' Safety Lamps was read by Mr. Morgan. In it special reference was made to Mr. Purdey's invention of an improved safety lamp, and Mr. F. H. Varley, Mr. Greenfield, and Mr. M. Zingler, who spoke on the subject, expressed their approval of Mr. Purdey's lamp. [This paper we cannot publish in our present issue].

EXECUTIVE COUNCIL.

On January 22nd, Mr. F. H. VARLEY, Chairman of the Executive Council, presided at this meeting, when the question of steps to be taken in regard to Patent Law Amendment in the forthcoming Session of Parliament were considered, but the question was adjourned till the next meeting.

It was resolved that in order to meet the necessary expenses of the Institute in carrying forward its work as to Patent Reform, a special subscription list be opened. The usual routine business concluded the proceedings.

Monthly Notices.

Dr. Percy's resignation of his position as Metallurgist to the Royal School of Mines has been accepted. But the laboratories at South Kensington are not ready for the students, and Mr. Richard Smith, Dr. Percy's laboratory assistant, has been requested to continue the lectures in the theatre of the Museum of Practical Geology, and the instruction *pro tem.* in the laboratory in Jermyn Street.—*Athenæum.*

Superior Magnets in Cast Iron.—According to the method of M. Carré in the *Revue Industrielle* is as follows:—He melts cast iron very slightly carburetted in earthen crucibles. He adds to it 1·5 per cent nickel, 2·0 per cent tin, and 0·5 per cent of copper. The result is stated to be very remarkable.

Not the least of Dr. Farr's claims, says the *Athenæum* (and we endorse this), on our gratitude is based on the literary skill which enabled him to make his "Life Tables" and other reports thoroughly readable as well as instructive. His epigrammatic style enlivened the dullest statistics; and he made us realize the truth of his own assertions, that "statistics underlie politics," and "statistics are a mode of national self-knowledge." Dr. Farr was a happy coiner of words and phrases, and to him may be attributed the introduction of more than one pregnant term in the sciences of nosology and biology—"zymotic" to wit. Now that the nation has finally lost his services through party political moves, we think it is nothing but right to testify to the value of his services.

The Gum Euphorbiaceæ of Natal, according to a statement in *Les Mondes*, if dissolved in alcohol and applied to metallic objects, preserves them from the action of sea and brackish waters. It is also said to preserve articles of wood from the ravages of the white ants.

Artificial Production of Diamonds.—In continuation of the criticisms on this subject, we extract the following from the *Athenæum*:—As soon as Mr. Maskelyne's letter appeared, Mr. Mactear wrote to the *Times*, affirming "in the most positive manner I have been able to produce carbon in the diamond modification; I have been able, on the only two occasions I have tried the experiment, to burn the small translucent particles in oxygen gas, and I have been able to scratch deeply both amethyst and topaz with them." On the sixth of January, Mr. Mactear went to the British Museum, "to convince Mr. Maskelyne himself of his being, to say the least of it, premature in his conclusions." He worked four days with the scientific men there, and what happened is set forth in his letter to the *Times* of Friday, the 16th; he there says: "The crystalline substance which I believed to be carbon in that condition is not so; it consists almost entirely of silica and alumina, and a small amount of magnesia, as well as a residue insoluble in hydrofluoric acid, even after the action has been prolonged over more than forty-eight hours. The residue, fused with caustic soda, still contained a very few minute crystalline forms, and particles of what we assume to be carbon in some graphitic form, which burns away on the application of a strong heat." Again, he says: "The pressure of carbon in some graphitic form will serve to explain the difference of opinion as to the combustibility of the substance, as, while a portion undoubtedly burns away, another, and by far the larger portion of the sample of crystalline substance we have been working upon, is little, or not at all, affected by a very high temperature." And, in conclusion, he writes: "While I most frankly admit that in this case my experiments have resulted in failure in so far as the production of crystalline carbon is concerned, yet the obtaining of substances closely resembling it in so many respects, and which seems actually to be of the nature of sapphire and ruby, is sufficiently interesting, and gives encouragement to continue the investigation which, sooner or later, I am certain will be successful."

The Educational Year Book for 1880, which has been recently published by Messrs. Cassell & Co., has this year been enlarged in order to make room for such topics as female education, professional and technical education, &c. Additional matter has also been introduced into those sections which deal with middle-class schools, the universities, local examinations, &c.

The lectures and lessons for teachers on the Science, Art, and History of Education will be resumed early this month at the College of Preceptors.

The Scientific Review

FEBRUARY, 1880.

ELECTRIC LIGHTING.

Electric lighting being one of the foremost subjects of the day, we think it desirable to give a prominent position in our columns to the paper "On the Present Position of Electric Lighting," by Mr. F. W. Campin, read at the meeting of the Inventors' Institute on 8th January. It was as follows:—

The time that has elapsed since I brought under the notice of the members of the Inventors' Institute a summarised account of the various plans of electric lighting then existent has not been idle time for the promoters and improvers of that system of lighting seeing it is happening just as I ventured to hint, that the shortcomings of the different inventions then before the public would be met and overcome. And although one cannot even now say that all practical difficulties have been removed, yet so much has been done in the direction of removal of practical objections that the Thames Embankment still continues to be lighted by electric lamps, and a thoroughly practical, and it seems highly successful, adaptation of the system has been effected by lighting the reading-room of the British Museum, and, according to what we hear, this is considered to be a very successful affair. In this case Dr. C. W. Siemens' invention has been adopted, and appears to give general satisfaction, which is what any one might expect who knows anything of that scientific celebrity, and bears in mind the fact that his invention has for some considerable time past been regularly and constantly employed in some of the extensive workshops of Messrs. Siemens Brothers, at Woolwich, with perfect success, where the men have become so accustomed to its bright and cheerful rays that they would not again work by gas-light if they could help it. When we state that one electric lamp, with suitable reflector, placed in a workshop, say sixty feet square, would give sufficient light over the entire area of the apartment for all practical purposes, it will be seen that for workshops the electric light is well suited. In cases where steam-power is not employed a gas engine may be applied with advantage, since it requires little or no attention after being got in motion.

For printing establishments, but more especially in the composing rooms, where a great number of gas-burners are generally required, and by which not only does the atmosphere become deprived of its oxygen, but vitiated by the accumulation of carbonic acid, the electric light would be of invaluable service. The atmosphere of some composing-rooms is so oppressive and unhealthy from the excessive, but necessary employment of gas, that it is not to be wondered at the average life of the compositor is estimated at about forty years. The electric light would probably increase his longevity while adding to his comfort during the nocturnal hours of labour.

When several workshops, compositor's rooms, or various apartments in a building are required to be lighted by electricity, the alternating current machine and differential lamp of Messrs. Siemens may be judiciously employed. The division of the light by this means is exceedingly important; and since it has been successfully adopted at the Library of the British Museum and elsewhere, it is, of course, applicable wherever a series of lights are required from a single machine.

Perhaps as good a summary of what has been done in regard to electric lighting as one can expect to have has been given by a journal of great authority on electrical matters, the *Electrician*, which in its issue of January 3rd, 1880, states:—

While no startling discovery has been made, progress has been continuous. We long ago pointed out that the future of the electric light was more a question of perfection of details than of new discoveries. Improve the machine, improve the lamp, and every step will be a gain. We think, although the opinion may be wrong, that the Gramme machine only requires improvements in certain directions to make it almost perfect, and that the time spent upon attempts to discover something new will not be so well spent as in attempting to improve what we have. As we say, some improvements have been made during the past year. The sole license for the Gramme machine here is the British Electric Light Company, 41, Parliament-street, E.C., and the experience of this company during the year is worthy of record. We learn that, owing to the variety of demands springing up for these machines, the company have produced some new classes of machines on the Gramme principle which are giving very satisfactory results. Several of these new machinss—which have only been in existence a few weeks—have already been sold. Another important advance made by this company is the acquisition of an arrangement for dividing the continuous current derived from the Gramme machines. This division is effected by aid of Blandy's patent magnetic governor coil. Many firms have already used the "coil" with satisfaction. The old problem of one machine and one lamp is therefore very wisely disputed. One important feature in the British Electric Light Company's position is to be found in the fact that, while being in possession of the Gramme machine, they are not prejudiced as to any particular lamp, but use all approved lamps best adapted to meet their various requirements. Among the more important contracts carried out by this company during the year may be mentioned the lighting of the Picton Reading-room, Liverpool; the steamship Mendoza; the North Shore Mills Company, Liverpool; the London and North Western Viaduct at Llandulas; the Milford Docks, South Wales; the Mersey Dock Works, Liverpool; and many others. With reference to the Picton Reading-room we noticed in a recent number of the *Times* that when the subject of the payment for the work came before the Corporation Committee the Liverpool borough engineer stated that the light as now applied was undoubtedly "a great success," while one of the members of the Committee said: "I think it is the most successful application of the light that has been seen in any part of England to the present time." With this testimony, we think the past year must have been a very satisfactory one in this country for the meritorious Gramme machine in the hands of the British Electric Light Company. We may add that the recent successful exhibitions of the light given by the company in the St. Enoch's Station, Glasgow, have resulted in their contracting with the railway company for the continued lighting of this large railway station by electricity, supplied, of course, by Gramme machines. It is well known that the experiments on the Thames Embankment have been very successful. The number of lamps has been largely increased, and it has been found that the magnificent engine of Ransomes, Sims, and Co. is capable of supplying the power requisite to drive the Gramme machines required for these lights. We have from time to time noticed the progress made, and thus may merely mention here that the engine and machines are stationed at Charing Cross Station, whilst the lights range from Blackfriars Bridge to the Victoria Station on the Metropolitan District Line. The rival of the Gramme machine is that of Siemens. The Lontin system has been very successfully applied at the Aldersgate-street Station of the Metropolitan Railway by the Electric Generator and Light Company.

Whatever merits may appertain to any of the plans of electric lighting that have been tested and applied, there is yet one system comparatively unknown in this country, that is the one known as the Brush system, which is thus referred to in an ably-written article in a recent number of the *Mining Journal*:—

It must have been almost obvious to most electricians, however much they may have hoped that they might be mistaken, that to make electric lighting a success it was necessary to construct an arc-light regulator or lamp, as it is more popularly called, as simple and at least as cheap as the lamps on the incandescent systems, and one with which a continuous current could be used, for it must be remembered that when the electricity is obtained from any dynamo-machine it is for continuous currents simply necessary to generate the supply required to compensate for the actual consumption, all the residual current being utilised; but for alternating currents there must be so much electricity generated as is required to make up for the loss of residual current at each reversal. These are the kind of facts which appear, from the results obtained, to have been most carefully kept in view by Mr. C. F. Brush, from whom the Brush system of electric lighting takes its name, and consequently he has produced a really reliable and economic electric light. Hitherto the best results obtained appeared to lead to the conclusion that 1½-horse power indicated would have to be accepted as the minimum power required for each light, and that five lights on a circuit was practically the limit even when all the conditions were favourable, whilst in many cases 1½-horse power per lamp represented but a small fraction of the power actually consumed.

The Brush system, as shown in operation by the Anglo-American Electric Light Co. at their works in Hatton Garden, the *Mining Journal* avers, showed that both these views were erroneous for 18 lights, each of 2000 candle power, were maintained on a single circuit with a 16-light Brush machine, driven by an 8-horse nominal engine, using 60 lbs. pressure of steam (and frequently a few pounds less), and yielding on Tuesday evening almost exactly 13½ indicated horse-power. The generators, the lamps, and the carbons are all the invention of Mr. Brush, and it is by the use of the three in conjunction with each other that the excellent results noticed have been obtained. The Brush dynamo-machines differ essentially in construction from all others in the armature in the arrangement of the field magnets, in the commutator, and in the novel mode of connection, thereby producing from a given amount of power a larger available current than has hitherto been obtained from any other combination. At the same time, the mechanical construction is such that the wear and tear is reduced to a minimum, the wearing parts (the segments of the commutators and brushes) being easily replaced when necessary by an ordinary mechanic at a trifling cost.

Another advantage which the machines possess is that they may be run for any number of hours continuously, and do not overheat or become less effective through continued use; further, by a special regulating attachment any smaller number of lights than the maximum that may be required can be employed, absorbing proportionately less power. The current derived is continuous, and of such a nature that it can overcome great external resistance. On the evening of exhibition the 16-light Brush was, with the horse-power already mentioned, running at a speed of between 700 and 750 revolutions of the armature per minute, and was generating ample current for 18 lamps, which were temporarily used, although the sixteen lamps which were used during the greater part of the evening are said (though the difference is not appreciable by the naked eye) to give the maximum of candle-power. The whole twenty-one lamps were on one circuit, which, by the use of a simple shunt, was constantly varied (though with no apparent difference of effect) from 250 ft. to 1½ mile, the arc in each lamp being 2 millimetres, or 1-12th in., in length, and each lamp consuming approximately 1½ in., or allowing for wasted ends 2 in. of carbon per hour, the cost retail of the carbon being 4d. per foot.

The Brush lamps or carbon regulators have all the advantages of—indeed, are in some respects superior to—the Serrin, which has hitherto been regarded as the best arc lamp constructed, whilst it is vastly more simple, less liable to derangement, and probably not one-tenth the price. The peculiar features of the Brush lamp are simplicity of construction, ensuring ease of management, safety against internal derangement, and regularity of working. The lamps contain no clockwork or other similar mechanism, and no regulation or adjustment of any kind is required beyond that of renewing the carbons when consumed. By means of the magnetic control and automatic cut-off each lamp, though in continuous circuit with many others, is independent in its working. Thus a mean length of arc, and equality of light and consumption of carbon is always maintained. The cut-off effectually guards against all dangers of general extinction; should any lamp in the circuit be accidentally injured or thrown out by consumption of carbon or other cause, the remainder are not affected. The simplicity of this cut-off could scarcely be surpassed, being merely a small electro-magnet, which is dormant so long as the lamp is in proper action, but the slightest irregularity permits a portion of the current to pass through the coil, pulls up the armature, and throws the lamp out of circuit. Should, however, the irregularity arise from a defect in the carbon, the lamp comes automatically into the circuit again as soon as the points regain correct position, which is of course the work of but an instant, the armature is released, and all goes on as before.

As evidencing the strong assurance that now exists that electric lighting is regarded as having obtained a somewhat certain position as a practical system of illumination, it may not be out of place to state that a new periodical, bearing as its sub-title the *Electric Light Journal*, has recently appeared which has supplied much of the information already given.

Here it will be desirable to take note that, while the Thames Embankment and Waterloo Bridge are successfully illuminated by the Jablochkoff candle, and the library of the British Museum by the Messrs. Siemens' admirable differential lamp, at last the electric light has found its way into one or two railway stations, that at Aldersgate-st. being lighted by the Lontin system, as above-mentioned, and Victoria Station by the Société Générale d'Electricité of Paris. The latter demonstration being described in the *Daily Telegraph* in a very intelligible way, it will not be out of place to quote the report of that journal:—"It is necessary to state, in justice to the French company and its managing director and engineers, that their experiment is not intended for continuance beyond a certain number of evenings. Were it supposed that the present undertaking is designed to be permanent, the inference would naturally be drawn at the expiration of the time agreed upon that the lights were withheld because the trial had failed. Nothing further from failure could possibly be imagined than the result of yesterday's operations, the effect being indeed a success more brilliant and entire than any yet attained by the system now in use. It was especially noticed by all who attended this interesting exhibition of underground illumination that the light burned with perfect steadiness, and without the least change of colour. The evidence recently given by Mr. Shoolbred on the subject of electric lighting, to the effect that fog has little or no perceptible influence upon its brilliancy and illuminating power, was confirmed in a remarkable degree, for while the dense mist that poured downward from the neighbourhood of the river, beneath the level of which the station is situate, caused the gas-lights to burn dimly, a totally opposite effect was apparent in the opalescent globes containing Jablochkoff candles. No machinery is placed at the station itself, the highly-insulated wires being laid along the tunnel and brought within the vault where the pumping engine is at work night and day to keep out the water which oozes through the gravelly soil. The lights at Victoria are maintained by the same steam power which produces the forty lights on the Thames Embankment and Waterloo Bridge, so that the twenty-horse engine of Messrs. Ransomes, Sims, and Head, worked near Charing Cross, is now maintaining sixty lights, and when a fourth battery of twenty-light Gramme machines, which has just been erected, shall be in use, will feed a total number of eighty lamps between Blackfriars and Victoria. Among the party who witnessed yesterday's experiment were Mr. Forbes, Mr. Mortimer Harris, Captain Godbold, and Mr. Vincent Hill, on the part of the railway company, and M. Jules Gaudet, managing director, and M. J. A. Berly, engineer, of the Société Générale d'Electricité. Punctually at half-past four o'clock, a little girl, daughter of the French engineer, was lifted on to a table in front of the wires, and by a simple action completed the two circuits of the Gramme battery, when all the ten lamps outside the cavern leaped splendidly into light as brilliant as a summer day, to the great astonishment of the assembled public on both platforms. Nine of the globes are distributed at intervals, and at a height of rather more than four yards above the foot-level on either side the railway, five being suspended over the down and four above the up platform. The tenth light is over the centre of the bridge that crosses the station. It may be observed that the distance marked on the chart of the District Railway between the stations of Charing Cross and Victoria is 2,373 yards; but the length of wire brought into use is considerably more than three miles. The actual frontage now illuminated by means of the central machinery at the Charing Cross point of the Embankment is nearly two miles and three-quarters."

Amongst names well known in connection with the practical application of electricity, Edison is perhaps as well known as any. It seems he has lately been operating for the improvement of the electric light with considerable success, as the following extract from the *Times* states that in the summer of 1878 Edison's experiments began to be made with the electric light. He supposed at first that the whole battle was won when he had found a plan to divide the electric current. He adopted for a lamp a coil of platinum wire, and endeavoured to perfect a regulator of the current which would allow the coil to become luminous without becoming so hot as to melt. He laboured diligently to perfect this device until about two months ago. About 17 feet of fine platinum wire were used in his coil. His first trouble grew out of the tendency of the current to form a voltaic arc between adjacent parts of the coil. Every time that an arc was formed his wire melted and disappeared in a flash of sparks. To insulate the coil with some material which would also become luminous was his constant effort. Zinc was tried and other materials. Wire made of iridium and other hard metals and various minerals were used, but all without success. Then the idea of enclosing the wire in a globe of glass from which the air had been exhausted occurred to him. Weeks and months of costly experiment with this idea followed. The vacuum was useful as it economised force. The radiation of heat was not so great in a vacuum, and a larger proportion of the energy of the current was saved for maintaining the luminous incandescence of the wire. The experts foresaw failure long before Edison did; and, finally, Edison himself reluctantly came to the conclusion last fall that he was on the wrong track entirely. The man wore himself out very nearly, and the disappointment almost sent him to his grave.

About two months ago the inventor resolved to test the utility of carbon. He was determined not to surrender until that had been done. What inspired him to make this departure was a trivial incident. One day he was busy with some lampblack and tar, with which he was making some wafers for a telephone. Happening to rub some between his fingers, he found he could draw it out into a thread. The thought came into his mind, "Why can I not make a carbon wire for an electric lamp?" After a little consideration, he began a series of experiments in this direction. He found that he could easily make a carbon wire, as had occurred to him, and that a burner for a lamp could be made from it. After several weeks of effort he found that a carbon wire, enclosed in a hermetically sealed glass globe, from which the air had been exhausted, would do well for a short time. It made a good light, and was satisfactory in that respect, but it was not durable. Invariably it was soon consumed. He then thought of the idea of taking a simple cotton thread, carbonising it in a retort, and making coils out of that. All sizes of thread and twine were tried. But even this material would not do. The texture of the carbonised thread was too loose. The material was better than lampblack and tar, but was not good enough. Then Edison tried common paper. He cut out thin strips of various kinds of paper, which he carbonised as before by laying them between sheets of tissue paper, enclosing them between cast-iron plates, and subjecting them to intense heat in a muffle furnace. The slips were cut out in the form of a horseshoe. One of these slips, made from Bristol board, was enclosed in a vacuum (if that be a proper expression) in a glass globe, the electric current being conducted to and from it by means of platinum wires. This was three or four weeks ago. The lamp thus made was tried. The horseshoe of carbonised paper became incandescent, and gave a beautiful mellow light, equal to that of one gas burner. It did not consume, and it lasted very well during the first day of experiment. Next day the same lamp was tried again. It behaved beautifully, somewhat to the surprise of Mr. Edison and his assistant. Both men now became very much interested. They instructed their glass-blower to make several lamps with great care; the pump perfected by Crookes and Sprengel was used to exhaust the air from the globes; and particular attention was paid to the matter of sealing the stems of the globes, which was done with a blowpipe. About two weeks ago experiments began with these lamps. They all behaved well, and a few days more served to show that a valuable invention had finally been evolved from the busy brain of the philosopher of Menlo Park. In fact, the lamp appeared to be complete.

A whole crop of new questions now sprang into view, one of them being the durability of the new style of incandescent carbon under a strong current. This question was readily disposed of. One lamp was raised to a power of 30 gas burners with perfect safety, and the capacity of the paper carbon to withstand an intense current appeared to be proved. As it is not the intention of Mr. Edison to make lights for dwellings of greater power than one or two gas burners, he considers that this part of the problem is disposed of. If a burner can be made to give the light of 30 gas burners with safety, it can surely be relied upon to give the light of one or two. Then came up another question. Ten lights could be maintained in the laboratory with the expenditure of one-horse power, or eight net in a dwelling. In practical use the current would be turned off and on suddenly. Would not the sudden turning on of a current of electricity, equal to one-eighth of one-horse power, rupture the carbon in time? One-eighth of one-horse power will drive several sewing machines, and when administered in the form of a blow is all a man would ever wish to have applied to his person. One of the men in the shops was detailed to turn on and off the current of electricity at one of the lamps. The man did this 5,000 times, which would be about the number of times that a lamp would be lighted in a dwelling in the course of 10 or 12 years. The lamp withstood this test perfectly. Various other questions came up and were promptly solved in the same manner by actual experiment. The state of feeling which reigned in the shops at Menlo Park as these experiments went on, and as it was found that the lamps sustained every test, can better be imagined than described. Every man, from Mr. Edison down, was first astounded and then exhilarated. They have had so many failures that they can now scarcely believe their senses.

There are now 45 lamps lighted every evening at Menlo Park, and the number is being increased as fast as the lamps can be made. Two or three of the dwellings in the village have been supplied with them, and a dozen or more street lamps along the road leading to the railway station have also been furnished with them. The others are in the shops. One of the latter has now been in use day and night for fifteen days, and is as good as when first put into operation.

The invention of this new lamp has not produced any very striking effect in regard to gas stocks here yet. Scepticism in regard to Mr. Edison's achievements is too strong yet. But a very decided effect has been produced with reference to the stock of Mr. Edison's Electric Lighting Company. There are 3,000 shares in the capital of the company, the par value of each being 100 dols. This stock was down to 20 dols. a share last summer, and a large number of the present holders bought at that price. The rise in value during the last two weeks has been enormous. The Hon. Roscoe Conkling, United States Senator from New York State, bought several shares this past week, and paid 3,000 dols. apiece for them. August Belmont, the banker, has bought during the past week at 3,500 dols. a share, and will take all that are offered at that price. Drexel, Morgan, and Co., bankers, who are already large holders, and, in fact, the principal owners are also buying at similar prices. There has been nothing like it in the history of stocks in New York city. Very few large holders of shares in the Edison Company are now willing to sell at 3,500 dols.; and the majority of the small proprietors are demanding and waiting for 5,000 dols. a share. The stock may never go to that height, because experiment may develop defects in the new lamp not yet observed; but the feeling in the company now is one of perfect confidence that the problem of household illumination has been solved, and higher quotations are predicted by them. The company is composed of merchants and bankers of high standing, and few of them are willing now to sell out except for very great inducements.

Mr. Edison himself does not indulge in extravagant assertions. I had a long talk with the inventor to-day and went with him all over the shops, learning every detail of construction of the lamps and examining the generators, air-pumps, furnaces, motors, and other apparatus. Mr. Edison makes no predictions, but says that he is going on until he has 150 lamps of the new pattern burning in the dwellings and streets of Menlo Park. It is his own test of the merits of the new lamp, the object being to develop defects. A few weeks from now he will be able to formulate a clear opinion about the merits of the invention. Wires are meanwhile to be run down to the village of Rahway, four miles distant, in order to test the difficulties of distributing the mains and lamps over a large area. Until the *data* afforded by the whole of this test are collected Mr. Edison will not declare his final opinion about this matter. He believes, however, that the new lamp can be distributed over a large area, and houses lighted therewith for the same price as now paid for gas, possibly less, but of the latter he is not certain. The lamps are four inches high, are simplicity itself in construction, and will cost to construct only 25c. apiece.

Although various prominent systems and applications of the electric light have thus been passed in review, yet it would be improper not to remark that other systems of more or less merit are now before the public; but want of time and difficulty in getting accurate information as to them prevents any detailed account being now given. However, it is to be hoped that inventors or promoters will at some future day bring them under the notice of the Inventors' Institute.

THE SOCIETY OF BRITISH ARTISTS' WINTER EXHIBITION.

[By a Correspondent.]

In this gallery there are nearly 900 pictures, many of which possess peculiar artistic features. Each work is priced in the catalogue, a system which it would be well for the Royal Academy to follow. In the first room (21), Cleopatra's Deadly Resolve in the Temple of Isis, by Madame de Steiger, is a classical picture possessing fine artistic qualities. The works of this clever artist have in some provincial exhibitions won favourable notice for their delicate colour and drawing. Cleopatra is represented reclining on a couch contemplating her fatal death. The whole work is admirably painted, solid and rich in tone and colour, while the face is an excellent study of character. There is a fixed purpose in the eyes, lowering with strong passionate will, and superstitious fears. A somewhat similar expression we have observed in Edward Long's masterly Egyptian studies. Above is a canopy, the perspective and tint of which is unique, and in the rear are Egyptian figures in keeping with the subject. We cannot but regret that this picture, which the judges have deemed worthy a place in the first rank, should be so badly hung. (14.) At Mechlin—by M. P. Mead—is also a well painted picture representing a bridge over the river Dyle. The colouring is bold and original: we think this artist exhibits great promise. (26.) Gate of Nicosia, Island of Cyprus—by H. Carrodi—is an attractive picture representing the market people entering the town. (151.) Wild Flowers—by A. F. Patten—the chief charms of this picture are the children crossing the brook. The whole has a pretty effect, and the tints are happily harmonized. This artist has been at some pains in drawing his figures. (211.) Playmates—by H. H. Couldery—is one of this well-known artist's charming pictures of his favourite cats, which studies have called forth the admiration of Ruskin, and other notable art critics. (246.) A Weedy Corner in the Isle of Wight. This picture carries one of the most charming spots in the island—the Undercliff. The wild flowers intertwined with the weeds form a scene of decided beauty.

There are many attractive pictures in the gallery this year, which need only be seen to be appreciated.

Mr. Aaron T. Hammer, of Sedan, Kan., has patented an improved sewing machine motor, which consists in the combination of devices by which the vertical motion of a platform is converted into rotary motion and transmitted to the band wheel when the platform moves down.

Proceedings of Societies.

ROYAL SOCITEY.

Dec. 11th.—The President in the chair.—The President announced that he had appointed as Vice-Presidents the Treasurer, Mr. Busk, Sir J. Hooker, Mr. Simon, and Dr. Tyndall. Prof. J. D. Everett was admitted into the society. The following papers were read: "Thermo-electric Behaviour of Aqueous Solutions with Mercurial Electrodes," by Mr. G. Gore; "Further Experiments on the Vapour Densities of Potassium and Sodium," by Prof. J. Dewar and Mr. A. Scott; "Quantitative Spectroscopic Experiments," by Profs. Liveing and Dewar; and "On the Practical Solution of the most general Problems in Continuous Beams," by Messrs. J. Perry and W. E. Ayrton.

Dec. 18th.—The President in the chair.—The following papers were read: "On the Secular Changes in the Elements of the Orbit of a Satellite revolving about a Tidally distorted Planet," by Mr. G. H. Darwin; "On Buff's Experiments on the Diathermancy of Air," by Dr. Tyndall; "On the Photographic Spectra of Stars," by Mr. W. Huggins; "On a new Method of Spectrum Obeservation" and "Note on the Spectrum of Hydrogen," by Mr. J. N. Lockyer; "On the Capillary Electroscope" and "Chemico-Electric Relations of Metals in Solutions of Salts of Potassium," by Mr. G. Gore; "On the Spontaneous Segmentation of a Liquid Annulus," by Mr. A. M. Worthington; "On the Histology of *Hydra fusca*," by Mr. T. J. Parker; and "On the Artificial Formation of Diamonds," by Mr. J. Mactear.

Jan. 8th.—The president in the chair.—The Right Hon. Lord Northbrook was elected a Fellow.—The Bakerian lecture, "On the Photographic Method of Mapping the Least Refrangible End of the Solar Spectrum," was delivered by Capt. Abney.

ASTRONOMICAL SOCIETY.

Dec. 12th.—Lord Lindsay, M.P., President, in the chair.—Mr. Stone showed a micrometer which he described as a compromise between the German and English forms. Mr. Neison read a paper, by Prof. Newcomb, "On the Correction of the Mean Longitude of the Moon." Referring to a paper published by Mr. Neison in the "Monthly Notices," Prof. Newcomb remarked that the fluctuation of the moon's errors, which Mr. Neison had suggested might be accounted for by a seventeen years' term, due to the action of Jupiter, should reach one of its maximum periods in 1878. According to Prof. Newcomb's computations, the observations of 1876 were not accordant with this theory by about 2″, and he suggested that this small residual error might be accounted for by an alteration of the personal equations of the observers at Greenwich and Washington, the only two observatories where a continuous series of observations of the moon's place were taken. Mr. Neison also read a paper of his own, prepared without any knowledge of Prof. S. Newcomb's suggestion, in which he discussed the changes in the moon's place as compared with the personal equation of the various observers who have succeeded one another at Greenwich Observatory. Mr. Ranyard read a paper by the Rev. T. W. Webb, "On a new Gaseous Nebula in Cygnus," which, when observed with a low power, looked like a bluish star of the ninth magnitude, and had been observed and registered as such by Arglander in the *Bonner Durchmusterung* as No. 4004 of zone +41. Observed with a higher power, it was seen to be a minute planetary nebula with a stella nucleus towards the north preceding edge. Observed with a spectroscope at Lord Lindsay's observatory, it showed the three bright lines which had been observed in many other gaseous nebulæ. Mr. Common gave an account of his observations of the satellites of Mars, as seen with his 37-inch Silver on glass reflector. Deimos now appeared to him as bluish, though, at the last opposition, he had thought it had a reddish tinge, which he had then compared to the redder parts of the planet's disc. For observing position angles of the satellites he had made use of a screen of dark glass across half the field of a negative eye-piece, so that the planet and cross wires could be faintly observed without dazzling the eye while the satellite was being compared with the position wires. Lord Lindsay read a note on the spectrum of the red spot on Jupiter, which he found to be an absorption spectrum, extending from the extreme red end up to a place between F and G, which he estimated as corresponding with wave-length 543mmm.

Jan. 9th.—Lord Lindsay, M.P., President, in the chair.—Messrs. E. A. J. Crossley, W. S. Franks, A. Riches, J. F. Sloman, W. Smith, and Rafael Rorg y Torres, of Barcelona, were elected Fellows.—Mr. Glaisher called attention to the magnificent Star Atlas and Catalogue of Dr. Gould, which have just been published by the Argentine Republic.—A paper, by Mr. H. Pratt, was read, "On the Rotation Period of the Planet Jupiter," which he has determined from observations of the great red spot which for some months past has been visible upon the planet. The rotation period determined is 9h. 55m. 33·91s., which differs about 7s. from the ordinary received rotation period. The observations indicate that if there is any drift of the great red spot on the surface of the planet, similar to the drift observed in sun spots, it must have been very uniform during the 321 rotations that have been observed.—Dr. Huggins gave an account of the methods he had employed for photographing the spectra of stars. The slit of his spectroscope is placed in the principal focus of a 15-in. Cassegrain reflector; one 60° prism of Iceland spar has been made use of. Iceland spar is very transparent to the ultra-violet rays, and has a dispersive power nearly equal to that of dense flint glass. An ingenious contrivance has been devised for keeping the image of a star upon the slit of the spectroscope, which is only 1-350th of an inch broad. No cylindrical lens has been made use of, and a linear spectrum of a star having been obtained the instrument is slightly moved, and another adjacent linear spectrum is taken, until the whole spectrum is sufficiently broad to be conveniently examined under the microscope. Some of these spectra, which are only about half an inch in length, were shown to the meeting. In one of them seven lines can be counted between the H and K lines, proving that the nebulous appearance of some of the broader lines is not due to any want of sharp definition.—Mr. Christie read a paper "On the Systematic Errors of the Greenwich North Polar Distances," and a lengthy discussion ensued upon Bessel's corrections for refraction.—Mr. Martin made an appeal to the Fellows of the Society to observe the brightness of the planet Mars towards the end of February, when it will be favourably placed with respect to Betelgeuse and *α* Orionis.

ASIATIC SOCIETY.

Dec. 15th.—Sir H. C. Rawlinson, President, in the chair.—A paper was read, contributed by Babu Rajendralala Mitra, "On the Age of the Caves of Ajanta," in which he urged—first, that the figures with flowing dresses and conical hats were Persians; secondly, that the chief personages in the drinking scenes were Bactrian; and thirdly, that the scenes represented phases of Indian life in the first century B.C. or A.D., founding his conclusions on the inscriptions existing in some of the caves, and adding at the same time many details with reference to the individual caves at this place. To this Mr. Ferguson replied that he could not accept the Babu's views for two reasons—first that there was no sufficient proof of the date of the inscriptions in the caves; and secondly, that, supposing they could bear he interpretation put on them by the writer of the paper, the architectural evidence was altogether opposed to his theory. Mr. Fergusson further pointed out that Babu Rajendralala had altogether ignored the fact that an inscription at Badami has preserved the date of 500 years from the coronation of the Saka kings, *i.e.*, A.D. 578-9, and the Babu ought to have known that this date is universally admitted to be the turning point of the cave chronology.

SOCIETY OF ANTIQUARIES.

Dec. 11th.—Dr. C. S. Perceval, Treasurer, in the chair.—Notice was given of a ballot for the election of Fellows on Thursday evening, January 8th, 1880, and a list of the candidates to be put up for ballot was read. Mr. P. O. Hutchinson communicated an account of some curious and, as it would seem from local traditions, ancient circular patches on a hill near Sidmouth. Mr. G. Payne, jun., gave an account of a discovery he had made, as recently as the 9th inst., at Chalkwell, near Sittingbourne, of a Roman lead coffin, the lid of which he exhibited, together with two gold armillæ, a jet armilla, and a small gold ring, which were found inside the coffin. Outside the coffin had been placed two large pitchers of red clay, one of them containing two small white, transparent glass cups, the whole being shattered into fragments by the pick. At the foot was a jug of fine hard flesh-coloured ware, originally painted black. On the coffin lid were two diamond-shaped designs, with an X-shaped ornament between them, which appear to have been moulded from a twisted thong. In the centre of each diamond was figured what seemed at first sight a sort of monogram of an I and a B, but which was more probably a representation of an ancient yoke. These also occur above and below the X ornament. There are also plain circular discs over the surface of the lid. Mr. Payne stated that the sides of the coffin itself were partially ornamented in a similar manner. From the size of the armlets and of the ring the interment was evidently that of a very young person. In fact, Mr. Payne stated that traces of the second teeth (not yet come through) were observable. It is seldom that two such remarkable "finds" of Roman remains have been laid before the Society at two consecutive meetings as those of which Mr. Payne has been the fortunate discoverer.—Mr. G. W. G. Leveson Gower exhibited an interesting collection of Roman remains found on his estate at Titsey Place, and communicated an account of successive excavations made by him at Titsey and at Limpsfield, in the vicinity of the "Pilgrims' Way," which runs through his property.—Mr. W. K. Foster exhibited a collection of objects found by himself in the lake dwellings at Peschiera. Many of these objects bore a close resemblance to those figured in Mr. Lee's translation of Dr. Keller's great work on lake dwellings, but some of them seemed to present new types.

STATISTICAL.

Dec. 16th.—T. Brassey, Esq., M.P., in the chair.—After the election of new Fellows Mr. R. H. Patterson read a paper, under the title "Is the Value of Money rising in England and throughout the World? With Remarks on the Effect of the Fluctuating Condition of Trade upon the Value of Money."

SOCIETY OF ARTS.

Dec. 15th.—Dr. Graham delivered the fourth of his course of lectures "On the Chemistry of Bread and-Making."

Dec. 17th.—Sir G. Bowyer in the chair.

—Seven candidates proposed for election as Members.—A paper "On the Panama Canal" was read by Capt. Bedford Pim, R.N., M.P.

MATHEMATICAL.

Dec. 11th.—C. W. Merrifield, Esq., President, in the chair.—The following gentlemen were elected Members: Messrs. W. Burnside, J. R. Harris, W. J. C. Sharpe, Dr. W. Jack, and Prof. W. W. Johnstone.—The following communications were made: "Note on a Method of Obtaining the q Formula for the Sine-amplitude in Elliptic Functions," by Mr. J. W. L. Glaisher,—"Note on a Numerical Theorem connected with the Cubical Division of Space," by the President,—"Notes on Curvature," by Mr. J. J. Walker,—and "A Property of a Linkage," by Mr. A. B. Kempe.

SOCIETY OF ENGINEERS.

Dec. 8th.—Annual Meeting.—Mr. R. P. Spice, retiring President, in the chair.—The following gentlemen were elected as the Council and Officers for the ensuing year, viz.:—President, Mr. J. Bernays; Vice-Presidents, Messrs. C. Horsley, T. Porter, and J. Church; Ordinary members of Council, Messrs. S. Cutler, F. E. Duckman, F. W. Hartley, A. Rigg, W. Schönheyder, J. Walker, P. F. Nursey, and C. Gandon; Honorary Secretary and Treasurer, Mr. A. Williams; Auditor, Mr. W. H. Bennett. The President announced that premiums of books had been awarded by the Council to Mr. C. J. Alford and Mr. J. Andrews.

SOCIETY OF TELEGRAPH ENGINEERS.

Dec. 10th.—Annual Meeting.—The following gentlemen were elected office-bearers for the year 1880: President, Mr. W. H. Preece; Vice-Presidents, Prof. Foster, C. Siemens, W. Smith, and Major Webber: Council, Prof. Adams, W. A. Andrews, W. T. Ansell, Sir C. Bright, H. G. Erichsen, Col. Glover, C. Hockin, Prof. Hughes, L. Loeffler, C. E. Spagnoletti, A. Stroh, C. F. Varley, Members, and A. J. S. Adams, Capt. M. Greer, and J. T. Hill, Associates; Hon. Treasurer, E. Graves; Hon. Secretary, Lieut.-Col. F. Bolton; Secretary, F. H. Webb.

PHYSICAL.

Dec. 13th.—Prof. W. G. Adams in the chair.—Eight new Members were elected.—Mr. J. H. Poynting read a paper "On the Graduation of the Sonometer," in which he reduced the indications of that instrument to absolute results.—Dr. A. J, Fleming exhibited a new "Wheatstone balance," designed by him to effect a strict comparison of the B. A. units of resistance deposited in the Cavendish Laboratory, Cambridge.—Prof. Perry described a "dispersion photometer" devised by him and Prof. Ayrton for comparing very strong lights with feeble ones.—Prof. Ayrton described the method employed by himself and Prof. Perry to determine the value of g, the co-efficient of gravitation at Tokio, Japan. They found it to be 980·06.—A spherometer designed by Mr. W. Goolden and made by Mr. Hilgar was also shown.

ROYAL SOCIETY OF LITERATURE.

Dec. 17th.—J. Haynes, Esq., in the chair.—A paper was read by Dr. Waldstein, "On the Group of Hermes and Dionysos by Praxiteles recently discovered at Olympia," in the Heræum at that place, the existence of which has been noted by Pausanias (v. 17, 3), and stated by him to have been the work of that celebrated sculptor. In this paper Dr. Waldstein pointed out that some doubt has been cast on this assertion by some recent German critics, who were inclined to attribute the work to a grandson of Praxiteles who bore the same name. He, however, showed, by a minute criticism of the sculpture, that there was really little ground for this theory, as the artistic character of the Hermes harmonizes perfectly with that of all the monuments which have been hitherto associated with the name of the elder Praxiteles, who is believed also to have greatly influenced Lysippus in the canon of human proportion he constructed. From the *figuræ quadratæ* of Polycletus and the slim, graceful forms of Lysippus, Dr. Waldstein urged that the sculptures of Praxiteles presented the natural transition. But the Hermes was really more than a point of transition in the development of Greek sculpture—it was a type by itself, as is clearly shown by the numerous replicas we have of it. Dr. Waldstein then discussed the sad and pensive element characteristic of Praxitelian art, and accounted for this both psychologically in the sculptor himself and historically from the times in which he lived, concluding his paper with a comparison of the age and works of Pheidias as contrasted with those of Praxiteles.

NUMISMATIC SOCIETY.

Dec. 18th.—W. S. W. Vaux, Esq., V.P., in the chair.—Messrs. A. Durlacher and J. W. Fowkes were elected Members.—Miss M. A. Hogg communicated a paper on a find of late Roman coins in the parish of Baconsthorpe, Norfolk; and Mr. P. Gardner two papers, one entitled "Sun-worship on Coins of Macedonia and Thrace," and the other "On the Coins of Elis." In this paper the writer attempted a chronological arrangement of the rich and beautiful series of the Elean money. He divided the history of Elis into fifteen periods, beginning about B.C. 480, and ending A.D. 217. To each of these periods Mr. Gardiner assigned coins, the silver staters of the earlier periods being probably issued in greater quantities at the period of the Olympic festivities than during the intervals. More care appears also to have been bestowed upon the coinage at Elis than elsewhere, and the types constantly change, facts which indicate that they were used rather in the place of issue than abroad. A curious fact mentioned by Mr. Gardiner was that during the recent German excavations of Olympia no silver staters of Elis have been discovered; the reason of this was probably that there was no city at Olympia, but only an occasional encampment.

LINNEAN SOCIETY.

Dec. 18th.—Prof. Allman, President, in the chair.—Mr. H. Seebohm was elected a Fellow, and Messrs. A. D. Bartlett, N. E. Brown, and F. H. Waterhouse were elected Associates.—Mr. B. Dayton-Jackson exhibited a complete series of the various editions of Dillenius's "Historia Muscorum," Oxford, 1741, and its reprint, Edinburgh, 1811, in illustration of the following communication.—The Rev. J. M. Crombie read a paper "On the Lichens of Dillenius ('Historia Muscorum') as illustrated by his Herbarium." The latter collection is preserved in the Botanic Gardens at Oxford, and the specimens, though well nigh 150 years old, are still in a good state of preservation. The earlier writers on cryptogamic botany, in their synonomy and nomenclature made constant reference to his descriptions; hence the present importance of an analysis of his material, and the more so as hitherto no systematic examination has been attempted, though some old writers have compared a few forms. Notwithstanding very considerable accuracy of identification of the Dillenian lichens, yet serious mistakes have crept in; Mr. Crombie reviews the series, and gives a conspectus and technical data, adapted to the present standpoint of botany.—Prof. Allman then gave a description of what appears to be true sense organs in the Hydroids. In one form the organ in question is a bulb with rod-like structures and a series of radiating filaments. These latter terminate at their extremities in conical bodies, containing filaments which resemble thread-cells, though differing physiologically. Another form is met with in a Medusa (Gemmellaria), where free, club-tipped filaments, constantly in motion, are attached to the manubrium, and possess sacs with thread-cells, but incapable of being exerted. Prof. Allman suggests the term *podocysts* for these, and says, from his observations in Myriothela and other genera, they have a wide extension among the Hydroids.

ZOOLOGICAL SOCIETY.

Dec. 16th.—Prof. Flower, President, in the chair.—The Secretary read a report on the additions that had been made to the Society's menagerie during November,—Mr. H. Seebohm exhibited and made remarks on a collection of Birds made by Capt. the Hon. G. C. Napier, in the valley of the Atreck,—Mr. R. G. W. Ramsay exhibited a specimen of *Pericrocotus flammeus* in an abnormal state of plumage, obtained on the Neilgherry Hills.—Mr. Sclater exhibited a small collection of birds from the island of Montserrat, West Indies, received from Mr. J. E. Sturge of that island.—Letters and papers were read: by Mr. T. J. Parker, on the intestinal spiral valve in the genus Raia: Mr. Parker showed that there were four types of valve exhibited in individuals of that genus, differing from one another in morphological characters, in the extent of absorption surface presented to the food, and in the resistance offered to the passage of food,—from the Marquis de Folin, on the Mollusca of the *Challenger* Expedition of the genera Parastrophia, Watsonia, and Cæcum,—by Prof. W. H. Flower, on the Cæcum of the Red Wolf (*Canis jubatus*),—from Mr. E. Bartlett, on the Mammals and Birds collected by Mr. Thomas Walters in South-East Betsileo, Madagascar,—by Dr. A. Günther, on a new species of Dwarf Antelope, obtained by Dr. Kirk near Brava in the South Somila country: Dr. Günther proposed for this new species the name of *Neotragus Kirki*,—from Mr. M. Jacoby, on a new species of Phytophagous Coleoptera,—from Prof. J. R. Greene, on a remarkable Medusa (*Charybdæa haplonema*) from Santa Catharina, Brazil,—by Mr. E. R. Alston, on the skull of a Chamois with four horns, which had been exhibited at a previous meeting of the Society,—and by Mr. H. Seebohm, on certain obscure species of Siberian, Indian, and Chinese Thrushes.

CHEMICAL SOCIETY.

Dec. 18th.—Mr. Warren De La Rue, President, in the chair.—The following papers were read: "On the Specific Volume of Water of Crystallization," by Messrs. T. E. Thorpe and J. J. Watts,—"Note on the Formation of Ozone during the slow Oxidation of Phosphorus," by Mr. H. McLeod,—and "On the Analysis of Organic Bodies containing Nitrogen," by Mr. W. H. Perkin.

ENTOMOLOGICAL SOCIETY.

Dec. 3rd.—J. W. Dunning, Esq., M.A., V.P., in the chair.—Mr. Howard Vaughan exhibited a series of extreme varieties of *Lycæna corydon* which had been taken at Dover.—Mr. W. L. Distant exhibited a hitherto unrecorded variety of *Danias plexippus* (commonly known as *D. archippus*), received from Antigua.—Mr. R. S. Billups exhibited some rare British beetles, and a specimen of *Carabus auratus* taken in the Borough Market.—Mr. C. O. Waterhouse communicated some interesting details as to tenacity of life in *Curculio cleonus*.—The Rev. H. S. Gordon read a paper entitled "Materials for a Reversion of the Lampyridæ."—Mr. Bates, in connection with the light-emitting power of this family, remarked that certain species of longicorns mimicked Lampyridæ with great exactness, the light-giving segments of the latter being perfectly represented in the longicorns although destitute of phosphorescent power.—Mr. J. W. Slater communicated a paper "On certain Minute Characters of Insects with reference to the Theory of Evolution."—A communication was received from Mr. P. H. Gosse "On *Papilio Homerus*, its Ovum and Larva,"—and a paper from Mr. R. Trimen "On some hitherto Undetermined Butterflies inhabiting Southern Africa."

MICROSCOPICAL SOCIETY.

Dec. 10th.—Dr. Beale, President, in the chair.—Ten new Fellows were elected.—The following papers were read: "On a Series of Experiments made to determine the Thermal Death-Point of known Monad Germs when the Heat is endured in a Fluid," by Mr. Dallinger,—"On the Classificatory Significance of Raphides in Hydrangia," by Mr. Gulliver,—"On a Part of the Life Cycle of *Clathrocystis æruginosa* (Kutz)," by Prof M. Duncan,—and "On a Simple Revolving Object-Holder," by Mr. W. Teesdale.

METEOROLOGICAL SOCIETY.

Dec. 17th.—Mr. C. Graves, President, in the chair.—Messrs. T. Buckland and G. Wigner were elected Fellows.—The following papers were read: "On a Sand-Storm at Aden, July 16th, 1878," by Lieut. H. H. Russell,—"On a New Form of Hygrometer," by Mr. G. Dines: this is a modification of the hygrometer which was first described at the British Association Meeting in 1872,—"The Diurnal Range of Atmospheric Pressure," by Mr. R. Strachan,—and "Note on a curious fracture of a Solar Radiation Thermometer," by Mr. G. M. Whipple.—Mr. R. H. Scott exhibited and described a new form of sunshine recorder, which is to be used during the coming year at a considerable number of stations distributed over England.

ANTHROPOLOGICAL INSTITUTE.

Dec. 9th.—E. B. Tylor, Esq., President, in the chair.—The President read some communications from the Rev. L. Fison and Mr. J. Forrest on Australian marriage customs, which will materially assist in clearing away the difficulties which surround this interesting subject.—In the absence of the author, the Director read a paper "On Savage and Civilized Warfare," by Mr. J. A. Farrar.—Mr. W. G. Smith exhibited a collection of sixty specimens of palæolithic implements, chiefly found in the valley of the Axe, many of them unusually large and heavy, and in an excellent state of preservation.—Four water-colour portraits of Tasmanians were exhibited, taken about forty years ago, and showing clearly all the physiognomical peculiarities of that interesting race.

NEW SHAKESPEARE.

Dec. 12th.—Mr. Furnivall, Director, in the chair.—The first paper read was by Mr. J. W. Mills, "On the Evidence that Shakespeare was, in 'Troilus and Cressida,' re-writing an old Play." This was clear in Act v., of which only the speeches of Thersites (and perhaps a few others) were Shakespeare's. To the same cause were due the inconsistencies in the character of Cressid, her first appearing pure, then impure, then pure again; the proposal of the grave Ulysses that Cressid was to be "kiss'd in general;" the sudden springing on Achilles of the Greek's knowledge that he was in love with Priam's daughter. Part of Act iv. sc. 2 could not be Shakespeare's, nor the kissing part of Act iv. sc. 5.—Mr. Furnivall read a paper, "Are the Philosophizings of Achilles in 'Troilus and Cressida,' Act iii. sc. 3, ll. 75-111, and of Aufidius in 'Coriolanus,' Act iv. sc. 7, ll. 37-55, and Lorenzo's lines on the 'patines of bright gold' in 'The Merchant of Venice,' Mistakes in Characterization on Shakespeare's part?" Rejecting the Achilles part of "Troilus," Act v., as genuine, and noting how Shakespeare had led up to Achilles' speech in Act iv. sc. 7, and had made Ulysses echo Achilles, rather than Achilles Ulysses, Mr. Furnivall contended that the reflective speech that had been questioned was rightly put into Achilles' mouth. So Aufidius, though a Volscian, was shown capable of his Hamlet-like speech on Coriolanus's career; and Lorenzo, though he was a bit of an adventurer, was yet an Italian and a gentleman, capable of impression by the "evening air, clad in the beauty of a thousand stars," and able to give expression to his feelings.—Mr. T. Tyler spoke on *hebenon* being an anagram of *henbane*.

GEOLOGICAL SOCIETY.

Dec. 17th.—H. C. Sorby, Esq., President, in the chair.—Messrs. J. Booth, P. N. Bose, E. S. Cobbold, D. M. F. Gaskin, J. F. Penrose, S. Seal, T. Tate, and R. Taylor were elected Fellows.—The following communications were read: "A Contribution to the Physical History of the Cretaceous Flints," by Surgeon-Major G. C. Wallich, M.D.,—and "Undescribed Fossil Carnivora from the Sivalik Hills, in the Collection of the British Museum," by Mr. P. N. Bose.

GEOGRAPHICAL SOCIETY.

Jan. 12th.—Sir Rutherford Alcock, V.P., in the chair.—The following gentlemen were elected Fellows: Capt. F. Bailey, Messrs. R. G. Bailey, R. Capper, C. de T. Chamberlaine-Bey, C. J. Fèret, J. Heaton, A. Hoare, P. A. Holland, J. O. N. James, H. Lè Crèn, N. Phillips, A. Riches, R. Vause, and S. Wheeler.—The papers read were, "The Grand Canal and Yellow River of China," and "Hankow to Canton Overland," by Mr. G. J. Morrison.

PHILOLOGICAL SOCIETY.

Dec. 19th.—Dr. J. A. M. Murray, President, in the chair.—The following papers were read: "*dare*, 'to give,' and *-dere*, 'to put,' in Latin," by Mr. J. P. Postgate, in which the current view of *credere*, &c., being compounded with *dha* (place) was opposed, it being maintained that all these words are compounds of *da* (give),—and "English Etymologies, correcting some of Prof. Skeat's," Part II., by Mr. H. Nicol. The etymologies discussed were those of "affray," "attire," "badger," "breeze" (cinders), and "costive."

SOCIETY OF BIBLICAL ARCHÆOLOGY.

Jan. 6th.—Anniversary Meeting.—Dr. S. Birch, President, in the chair.—After the nomination and election of Members, &c., the Annual Report of the Secretary for the Session 1878-1879 was read.—The following Officers and Council for the current year were elected: President, Dr. S. Birch; the Right Rev. Joseph Barber Lightfoot, D.D., &c., Bishop of Durham, was added to the list of Vice-Presidents; Council, Rev. J. Augus, Rev. J. C. Ball, Rev. Canon Beechley, W. Besant, T. Christy, R. Cull, R. Cust, C. D. Fortnum, Sir H. S. Giffard, C. Harrison, H. H. Howorth, Rev. A. Löwy, Prof. E. L. Lushington, J. M. Norman, Hormuzd Rassam, P. le Page Renouf, J. Sidebotham, and Prof. W. E. Wilson; Hon. Treasurer, B. T. Bosanquet: Secretary, W. H. Rylands; Hon. Secretary, A. Cates; Hon. Secretary for Foreign Correspondence, Rev. A. H. Sayce; Hon. Librarian, W. Simpson.—A communication giving an account of the monuments and inscriptions on the rocks on the Nahr-el-Kelb river, Syria, by Mr. W. St. Chad Boscawen, was read by the Secretary.

INSTITUTION OF CIVIL ENGINEERS.

Dec. 23rd.—Annual General Meeting.—Mr. Bateman, F.R.S., President, in the chair.—In the report of the Council it was stated that there was no more important subject for the consideration of the members, than the question whether the objects of the society had been adequately fulfilled, and, if not, then in what way they could hereafter be more properly carried out. A succinct account was first given of the periodical meetings for the readings of papers and for the discussion of engineering topics, leading to a review of the publications of the institution, which for the past five years had comprised four volumes of "Minutes of Proceedings" annually. These volumes embraced original communications other than those read at the meetings, and also abstracts of papers either addressed to similar bodies abroad, or printed in foreign scientific or technical periodicals. During the past session these volumes—issued respectively in the months of March, May, July, and September—had together contained 1704 pages. The Minutes of Proceedings proper, including the papers read at the meetings, reports of the discussions upon them, and written remarks, embraced 885 pages, the other selected papers occupied 343 pages, the obituary notices of deceased members 80 pages, and the abstracts of memoirs contributed to foreign societies and periodicals 396 pages. Every member, whether belonging to or only attached to the institution, and wherever resident, received post free, a copy of each volume, as published. The advancement of scientific knowledge, more especially in its application to engineering, was, without doubt, materially promoted by the meetings, which afforded opportunities for the interchange of opinion among the best authorities on the topics brought forward; and the complete and rapid circulation given to the records of such meetings, supplemented as it was now by the additions described, furnished, perhaps, the most efficient plan that could be devised for the collection of information on all those many sciences upon which the successful practice of engineering depended, and for its dissemination to the many members resident in distant countries, where access to current engineering literature was difficult. The members were again urged to contribute the particulars of the mode of execution, the details of construction, and the cost of works at home, as well as to furnish short notes of useful facts and deductions acquired in the course of practice and observation. The next means that might be pointed to for promoting the objects of the institution was the library. Tracing its gradual progress, it was remarked that at present the collection contained 15,500 separate volumes, besides about 420 volumes of pamphlets. The members were reminded that the advanced position of this unrivalled collection of technical literature could only be preserved unimpaired by suggesting the titles of important professional treatises not already in the library, and particularly by presenting copies of their own works and reports as published or printed. An account of the operations and condition of the institution during the past twelve months was then rendered. From this it appeared that there had been twenty-four ordinary meetings, at which sixteen papers were read and discussed, the authors of these receiving Telford premiums for their communications. Twenty-five other papers were selected for publication, and the authors of four of these had been similarly rewarded. There had also been eight students meetings, when as many papers were read, and Miller prizes had been bestowed upon four of these authors. During the year the Council were engaged in effecting the separation of the professional from the non-professional associates, in accordance with the directions of the special general meeting of the 2nd of December, 1878. The qualifications and antecedents of 1670 associates had to be separately considered, of whom 1080 had been taansferred to the group of associate members, leaving a residue of 590 in the original class. The elections had comprised 1 honorary member, 40 members, and 152 associate members, besides 23 associates not entitled to the privileges of corporate membership; while 68 associates had been transferred to the class of members. On the other hand, the deductions had been, by deaths, resignations, and erasures, 71 members, associate members, and associates. There had been an addition in the twelve months of 1 honorary member, 79 members, and 65 associate members or associates, representing a total increase of 145. The gross numbers on the 30th of November last were: 17 honorary members, 1140 members, 1221 associate members, and 582 associates, making a total of 2960, irrespective of the students. This aggregate was more than double what it was twelve years ago. The student class now numbered 584, of whom 150 were admitted last session, when 42 members were elected associate members, and 24 ceased to remain on the list, so that the net increase had been 84. The statement of accounts showed that the receipts, grouped under three heads, were—from annual subscriptions and from dividends on institution investments £10,960 11s. 9d., from admission fees and life compositions £2837 12s. 6d., and from trust funds £431 13s. 5d., together £14,229 17s. 8d. On the other hand, the disbursements, similarly distributed, were—for ordinary expenditure £9826 10s. 7d. (including £4568 19s. 3d. on account of "Minutes of Proceedings"), for institution investments £4093 1s. 2d., and for trusts £530 18s. 9d., making a total of £14,450 10s. 6d. The difference between the two sides of the account was met by the bankers' balance being less by £220 12s. 10d. than it was twelve months ago. The accumulated property of the institution now amounted to £31,094 1s. 8d., the interest on which constituted rather more than one-tenth of the annual income. The nominal or par value of the trust funds, held for the purpose of awarding premiums, was £14,642 13s. 10d., the whole of which stood in Government securities. In conclusion, the belief was expressed that, both in its organisation and in its method of procedure, the Institution of Civil Engineers was distinctly and definitely dedicated to the promotion of science, that its present prosperous condition might be taken as a convincing proof of the high esteem in which it was held, and that a confident hope might therefore be entertained that its practical and useful character would be as fully and as completely maintained in the future as in the years gone by. The report having been adopted, the premiums and prizes awarded at the close of last session were presented by the President, to whom the thanks of the meeting were unanimously voted, the services of the Vice-Presidents and Council, and of the auditors being similarly acknowledged. The Scrutineers (to whom a vote of thanks was passed by acclamation) reported that the following gentlemen had been duly elected to fill the several offices of the Council for the ensuing year:—Mr. William Henry Barlow, F.R.S., President; Mr. J. Abernethy, Sir W. G. Armstrong, C.B., F.R.S., Sir J. W. Bazalgette, C.B., and Mr. J. Brunlees, Vice-Presidents; Mr. G. Berkley, Mr. F. J. Bramwell, F.R.S., Mr. G. B. Bruce, Sir John Coode, Mr. E. A. Cooper, Mr. A. Giles, M.P., Sir Charles A. Hartley, Mr. H. Hayter, Dr. W. Pole, F.R.S., Mr. R. Rawlinson, C.B., Dr. C. W. Siemens, F.R.S., Mr. D. Stevenson, Sir W. Thomson, F.R.S., Sir Joseph Whitworth, Bart., F.R.S., and Mr. E. Woods, other members of Council.

An improvement in dumping waggons has been patented by Miss Annie McFarlane, of San Bernardino, Cal. The object of the invention is to provide a cheap, simple, and convenient dumping cart or barrow that will be especially serviceable in mines.

HUNT'S GUN AND PROJECTILE FOR EFFECTING COMMUNICATION WITH WRECKED VESSELS.

The first invention of this kind which was brought practically into use (says the "Life-Boat, or Journal of the National Life-Boat Institution," an association deserving the support of everybody) was the means of saving, in the aggregate, numberless lives, and was designed by the late Captain Manby, in the early part of the present century. It consisted of a small brass mortar, from which a twenty-four-pound iron shot was thrown, with a line attached, which line, carried over a stranded vessel by the shot, was secured by the crew, who by its means were then enabled to haul on board a block having a strong but light line rove through it, both ends of the line being left in the hands of the helpers on the shore.

Those on board had then only to make the block fast to the rigging or one of the masts, for which purpose a stout rope, termed a tail, was spliced to it, and those on the land, having command of both ends of the line, were enabled to haul off a strong hawser, along which they hauled the crew one by one, or sometimes two together, to the shore in a canvas cot suspended to and traversing on the hawser.

Although rockets were subsequently adopted in lieu of the shot to carry the first line over a vessel, on account of their greater portability and longer range, in other respects the apparatus is but slightly changed, and Captain Manby is entitled to the whole credit of the original idea and of its first practical application.

The use of the rocket as a propeller or projectile for carrying the line, was first proposed by the late Mr. Dennett, of Carisbrooke, in the Isle of Wight, and his rockets were supplied for many years, jointly with the Manby apparatus, by the Board of Customs, which had then the control of the Coastguard service.

On the Coastguard, however, being transferred to the Admiralty, and the supply and management of the life-saving apparatus to the Board of Trade, under the provision of the Merchant Shipping Act of 1854, the latter Board exclusively adopted the rocket, in which a further improvement had been made by Colonel Boxer, of the Royal Artillery, whereby a considerably longer flight was obtained. That agparatus is now especially known as the English life-saving apparatus, it not having been adopted, we believe, by any foreign countries, chiefly on account of the expensive character of the rockets.

Mr. Edmund J. Hunt, of Weymouth, Massachusetts, now comes into the field, and claims for his plan certain advantages over the rocket, viz., a longer range, a truer aim, especially in a high wind; and comparative cheapness.

It is a return to Captain Manby's plan, in so far as that it is a shot discharged from a gun; but the shot, or projectile, is of very peculiar character, its chief characteristic being that it contains within it a large portion of the line to effect communication with the stranded ship, the result being—1st. That the line, not having to be dragged along its whole length from the shore, but withdrawn from the projectile during its flight, the latter is not impeded by it, and a longer range is thereby obtained. 2nd. That the projectile and line are not carried to leeward of the line of fire by the force of the wind when the latter is blowing athwart its course, a truer direction being thereby obtained.

The projectile is, in fact, a tin cylinder or tube, 20 inches long, by 3¼ inches in diameter, with a solid leaden shot of the same diameter at one end, the remainder of the tube having tightly coiled within it a small but strong flax line, saturated with paraffin, and said to have a breaking strain of about three hundredweight. The projecting end of this line, when a shot is about to be fired, is knotted to another cord in a cylinder on the shore, being a supplementary line to the other, a portion of it being drawn on upon the first starting of the projectile, and any further amount required towards the close of its flight, when it has discharged all the line within it. After being discharged, the line cannot be again recoiled within the cylinder by hand, as it has to be done by a machine constructed for the purpose; but a sufficient number of the projectiles would be supplied to each station, and they could, after use, be re-filled at leisure, the cost of each discharge being under seven shillings, which is, we believe, much less than half that of a Boxer's rocket.

The weight of a projectile, ready for use, is 12½lb., that of the gun averaging about 60lb.

On the 14th March last an experimental trial of Mr. Hunt's apparatus was made at Shoeburyness by the Royal Artillery stationed there, for the information of the Board of Trade, Commander Prowse, R.N., the superintendent under that Board of the life-saving apparatus on the coasts of the United Kingdom, being present, also the colonel in command at Shoeburyness, officers of the Royal Artillery, Mr. Hunt, the inventor, and others.

The results of the trial, as regards range, certainty, and accuracy of direction, were very favourable, the range varying from 300 to more than 500 yards, according to the amount of powder-charge; whilst the direction was so good that not a single shot would have failed to throw the line over an ordinary boat, and not a single line was broken. There was but little wind at the time, much to the regret of the inventor, who stated that in a high wind, either adverse or athwart, the merits of his invention would be still more apparent.

There remain, however, two points which require to be tested by actual experience before the relative advantages of the Government rocket apparatus and that of Mr. Hunt can be confidently stated, viz.:—

1st. The greater weight of the gun and its bed as compared with the rocket-tube and stand.

2nd. The comparative smallness of Mr. Hunt's lines.

At some stations portability is undoubtedly of much importance, but there are many others where it is of comparatively little, and the weight of this gun and bed, between 80lb. and 90lb., slung to a pole, could be readily carried by two men.

The smallness of the line is certainly a disadvantage, as, although it is said to bear a strain of 3cwt., being only of the thickness of an ordinary goose-quill, it would not be grasped so well by men hauling on it as would a stouter line, and would be liable to cut their hands or slip through them should a severe strain be put on it. As it is, however, in actual use by the Massachusetts Humane Society at their live-saving stations, and has been favourably reported on by it, that question will in a short time be solved, if it has not been so already. That society has handsomely presented to the National Life-Boat Institution one of Mr. Hunt's guns, with projectile and lines complete. Since, however, the Institution does not undertake the provision or management of any other life-saving material than that of the life-boats, it has no practical use for the gun, &c., which it has therefore deposited at the museum of the Royal Service Institution, Whitehall-yard, London, where it may be seen by any one taking an interest in the subject.

Mr. Benjamin F. Walters, of Norfolk, Va., has invented an improved machine for removing the stems, particles of dirt, and other adhering impurities from peanuts, and for polishing and assorting

THE INVENTORS' INSTITUTE,

ESTABLISHED 1st MAY, 1862.

FORTNIGHTLY MEETINGS, DURING SESSION,

HELD (NOVEMBER TO MAY INCLUSIVE) AT

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, W.C.

PAST PRESIDENT—SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the Establishment of the INVENTORS' INSTITUTE till his decease, February, 1868.

PAST PRESIDENT—LORD RICHARD GROSVENOR, M.P., &c., from February, 1868, till May, 1871.

Council:

PRESIDENT OF THE INSTITUTE,

SIR ANTONIO BRADY.

The Right Hon. The Earl of Caithness, Vice-Pres.
*Sir Thomas Fairbairn, Bart., Vice-Pres.
*Beresford Hope, Esq., M.P., Vice-Pres.
*His Grace the Duke of Manchester, Vice-Pres.
*Robert Richardson, Esq., C.E., Vice-Pres.
*Adml. Jasper Selwyn, R.N., Vice-Pres.
*Cromwell F. Varley, Esq., F.R.S., &c., Vice-Pres.
*Sir Henry Bessemer, Vice-Pres.
*C. Williams Siemens, Esq., C.E., D.C.L., F.R.S., Vice-Pres.
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